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JOURNAL

OF THE

AMERICAN PEAT SOCIETY

A QUARTERLY JOURNAL DEVOTED TO THE DIFFUSION OF KNOWLEGE OF THE UTILIZATION OF PEAT, AND THE DEVELOPMENT OF AMERICAN PEAT RESOURCES.

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CONTENTS AND INDEX.

VOLUME III.—APRIL, 1910, TO JANUARY, 1911.

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Address of Welcome.....CONTROLLER HINCHEY, 91
Akerlund Gas Producer.....C. P. WOOD, 209
American Refining and Reduction Company..... 31
American Peat Society, List of Members..... 77
American Peat Society, Roster of Fourth Annual Meeting. 87
Annual Meeting, Notice of..... 40
ANREP, A. JR.—Peat Work in Canada..... 103
ASTOR, COL. J. J.—Vibratory Disintegrator..... 224
Banquet at Hotel Victoria..... 159
Biographical Sketch, Dr. Eugene Haanel..... 83
BULASK, FRANCIS J.—Work of Peat Engineering Co..... 131
Business Opportunities 75
Canada, Peat Work in.....A. ANREP, JR., 103
Canada, Review of Peat Industry in...ALEXANDER DOBSON, 144
Canadian Experimental Peat Plants.....A. R. MAUJER, 233
Canadian Government Peat Plants..... 79
Canadian Peat Experimental Plant..... 71
CARL, M. EARL—Peat and Muck Lands in New York, The. 14
Coking Peat. A New Process for.....W. L. SHEPARD, 20
Commercial Artificial Fuel Co..... 31
Commercial Peat; Its Uses and Possibilities (A Review).. 38
Conservation (Editorial Note) 74
Continuous Vacuum Filters as Dewaterers.....
ROBERT SCHORR, 49, 244
Correspondence..... 35
CREAMER, WALTER J.—The Process of The Peat Manufacturing Co. 23
Cutting Peat by Wind Power..... 83
DAVIS, CHARLES A.—
Problem of Production of Peat Fuel for Gas-Producers..... 24
Response to Toast 163
Drier, A New Patented.....C. E. MARK, 195
Drying of Peat.....DR. J. MCWILLIAM, 185
Drying Problem, A Peculiar..... 72
Editorial Notes 26, 68, 247, 249
EICHOFF, WM. M. E.—The Future of the Peat Industry in America..... 218

Ekenberg, Dr. Martin, Death of 31
Excursion to Government Peat Fuel Plant 104
Exploitation of Our Peat Bogs for the Production of Fuel for Domestic Purposes (President's Address) ..... DR. EUGENE HAANEL, 111
European Process Peat Co 30
Fertilizer, Peat as, and Some Methods of Drying and Preparing ..... ROBERT RANSON, 173
Fertilizers, The Importance of Peat for the Manufacture of Nitrogenous ..... ROBERT SCHORR, 226
Fertilizer Experiments with Peat 73
Finance Committee, Report of 139
FISHER, HON. SIDNEY, Minister of Agriculture, Canada,—Response to Toast 167
Florida Peat Plants, Some ..... ROBERT RANSON, 53
FOSTER, COLONEL, U. S. Consul to Ottawa—Response to Toast 160
Fourth Annual Meeting, Notice of 68
Fourth Annual Meeting of The American Peat Society at Ottawa, Proceedings of 87-232
FRANK, FRANK—Peat Fuel by Frank's Process 212
Fuel Used in Steam and Gas Plants 75
Full Table of Contents of Vol. III., Nos. 3 and 4 81
Future of the Journal of the Society 141
Future of the Peat Industry in America. WM. EICHOFF, M. E., 218
Gas-Producers, Problems of Production, Peat Fuel for, CHARLES A. DAVIS, 24
Gas-Producer, The Akerlund ..... C. P. WOOD, 209
Gas-Producer, The Zwingenberger 71
Haanel, Dr. Eugene, Biographical Sketch of 83
HAANEL, EUGENE—Exploitation of Our Peat Bogs for the Production of Fuel for Domestic Purposes, (President's Address) 111
HASKINS, PROF. H. D.—The Utilization of Peat as a Source of Nitrogen 41
HINCHEY, CONTROLLER—Address of Welcome 91
HOFF, J. N.—Problems in Peat Filler Production 192
Indiana, Peat Developments in 31
Indiana, Peat Paper Plant for 69
Importance of Peat for the Manufacture of Nitrogenous Fertilizers, The ..... ROBERT SCHORR, 226
International Power Manufacturing Co 72
Irish Peat Industries 65
Journal of the Society, Future of 141
List of Members of the American Peat Society 77

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Mark, C. E.—A New Patented Drier..... 195
Maujer, A. E.—Canadian Experimental Peat Plants..... 333
McWilliam, Dr. J.—
Drying of Peat..... 62
A Report of the Milne Process for Making Peat Fuel..... 185
Response to Toast..... 171
Meeting in New York with Peat Exhibit..... 64
Members of the American Peat Society, List of..... 77
Michigan Peat Co., Plant of..... 82
Mighill, Dr. T. Arthur—Peat Power Generation..... 118
Milne Process for Making Peat Fuel, Report on. Dr. J. McWilliam, 62
Minnesota, Peat Exhibition in..... 34
Minnesota, Peat Resources of.....Max Toltz, 1
Minnesota Peat Fuel Co..... 69
Mond, Dr. Ludwig, Death of..... 33
Moore, Ernest V.—A New Portable Peat Machine..... 151
Moulton, O. E.—Progress in Peat Briquetting..... 186
Multum in Parvo, The Peat Engineering Co..... 11
National Peat Fuel Gas Co., The.....30, 32
National Peat Utilization Co..... 29
Newfoundland Peat as Fuel..... 34
New Patented Drier, A.....C. E. Mark, 195
New Portable Peat Machine, A.....Ernest V. Moore, 151
New Process of Preparing Peat for Fuel..... 232
New Process for Coking Peat.....W. L. Shepard, 20
Newspaper Clippings, Poor Sources of Information..... 69
Notes, Editorial.....26, 68, 244, 249
North Carolina Peat..... 74
Opening Address—Hon. Clifton Sifton, Chairman Conservation Committee of Canada..... 105
Opportunities, Business.....75, 76
Outlook, The (Editorial)..... 27
Peat, A New Process for Coking.....W. L. Shepard, 20
Peat and the Production of Power.....Herbert Philipp, 57
Peat and Muck Lands of New York.....M. Earl Carl, 14
Peat as a Fertilizer and Some Methods of Drying and Preparing It.....Robert Ranson, 173
Peat as Fuel, New Process for Preparing..... 232
Peat Bogs, Exploitation of Our, for the Production of Peat Fuel for Domestic Purposes, (President's Address).....Dr. Eugene Haanel, 111
Peat Bogs of Canada, The Study of..... 71
Peat Briquetting, Progress in.....O. E. Moulton, 186
Peat Coal and Gas Co..... 29

Peat Cutting by Wind Power..... 33
Peat Deposits in Vermont..... 71
Peat Developments in Indiana..... 31
Peat, Drying of .....Dr. J. McWilliam, 185
Peat Engineering Co., Multum in Parvo..... 11
Peat Engineering Co. of Toledo..... 23
Peat Engineering Co., Work of.....Francis J. Bulask, 131
Peat Exhibition and Meeting in New York..... 64
Peat Exhibit in Minnesota..... 84
Peat Filler Production, Problems of.....J. N. Hoff, 192
Peat Fuel, A Report on the Milne Process for Making,
Dr. J. McWilliam, 62
Peat Fuel by the Frank Process.....Frank Frank, 212
Peat Fuel for Gas-Producers, Problems and Production of,
Charles A. Davis, 24
Peat Fuel Plant at Alfred, Excursion to 104
Peat Fuel Manufacture in Minnesota..... 30
Peat Industries, Irish 65
Peat Industry in America, The Future of,
Wm. E. Eichoff, M. E., 218
Peat in Russia 242
Peat Machinery and Production of Peat
J. H. Van Glahn, 46, 236
Peat Manufacturing Co., The Process of The,
Walter J. Creamer, 23
Peat Manufacturing Co., of Bangor, Maine..... 74
Peat Paper Plant for Indiana..... 69
Peat Patents. 75
Peat Plants, Canadian Government.....A. R. Maujer, 232
Peat, Possibilities of 73
Peat Power Generation .....Dr. T. Arthur Mighill, 118
Peat Products Co., The..... 32
Peat Resources of Minnesota.....Max Toltz, 1
Peat, The Utilization of, as a Source of Nitrogen,
Prof. H. D. Haskins, 41
Peat, The Value of 29
Peat Work in Canada .....A. Anrep, Jr., 103
Peculiar Drying Problem, A..... 72
Philipp, Herbert—Peat and the Production of Power.... 57
Possibilities of Peat 73
Power Generation from Peat..... 69
President's Address .....Dr. Eugene Haanel, 111
Problems in Peat Filler Production.....J. N. Hoff, 192
Proceedings of the Fourth Annual Meeting of the American Peat Society at Ottawa, Canada.....87-232

Production of Peat and Peat Machinery,
J. M. Van Glahn, 46, 236
Program of the Meetings of Fourth Annual Meeting, American Peat Society 89
Progress in Peat Briquetting.....O. E. Moulton, 186
Propositions for the Welfare of the Society..... 99
Publications. 39
Questions. 37
Ranson, Robert—
Some Florida Peat Plants..... 53
Response to Toast 167
Peat as a Fertilizer and Some Methods of Drying and Preparing It 173
Reid, J. R.—Toastmaster's Address 173
Reports from Vice-Presidents of Sections..... 94
Report of Finance Committee..... 169
Report on Milne Process for Making Peat Fuel,
Dr. J. McWilliam, 62
Response to Toast..Colonel Foster, U. S. Consul, Ottawa, 160
Response to Toast,
Charles A. Davis, Peat Expert, U. S. Bureau of Mines, 163
Response to Toast,
Robert Ranson, Vice-President Southern Section, American Peat Society, 167
Response to Toast,
Hon. Sidney Foster, Minister of Agriculture, Canada, 167
Response to Toast,
Dr. J. McWilliam, Vice-President Canadian Section, 171
Review, Commercial Peat; Its Uses and Possibilities..... 38
Review of the Peat Industry in Canada,
Alexander Dobson, 144
Resolutions of Thanks and Appreciation..... 201
Roster of the Fourth Annual Meeting of the American Peat Society. 87
Russia, Peat in 242
Schorr, Robert—
Continuous Vacuum Filters as Dewaterers.....49, 244
The Importance of Peat for the Manufacture of Nitrogenous Fertilizers 22
Sections, Reports of Vice-Presidents of..... 94
Shepard, W. L.—A New Process of Coking Peat..... 20
Sifton, Hon. Clifton, Chairman Canadian Conservation Committee—Opening Address 105
Some Florida Plants.....Robert Ranson, 53, 240
Steam and Gas Plants, Fuel Used in..... 75
Swamp Drainage in Minnesota..... 32

Toastmaster's Address—
J. R. Reid, Pres. Ottawa Board of Trade..... 159
Toltz, Max—Peat Resources in Minnesota..... 1
U. S. Bureau of Mines..... 71
Utilization of Peat as a Source of Nitrogen, The,
Prof. H. D. Haskins, 41
Van Glahn, J. H.—Peat Machinery and the Production
of Peat 48, 238
Vermont Peat Deposits..... 71
Vibratory Disintegrator 224
Wood, C. P.—The Akerlund Gas-Producer..... 209
Zwingenberger Gas-Producer, The 71

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THE PEAT RESOURCES OF MINNESOTA.

Max Toltz, St. Paul, Minn.

(Read at the First Minnesota Conservation Congress.)

During the last two years, great interest has been shown by investors, manufacturing and engineering companies, and agricultural people, to obtain information relating to our peat resources. Although the general public, even today, has little knowledge of this material, this poor peat, despised by farmers, sometimes cursed by engineers and road-builders, and often claimed to be a detriment to our general welfare by most of mankind, it will be the endeavor of the writer to show that this material can be of national importance, and should receive the same attention that is now paid to grain, lumber, ore and other natural resources, which have made this country wealthy and prosperous; and that especially here, in our state of Minnesota where this substance is found in abundance, it can be utilized, not alone to increase our wealth, but to make our state a rival of Eastern iron and steel producing states.

Naturally the questions asked will be, "What is Peat?" and next, "Where can it be found?" and thirdly, "What is it good for?"

Definition of Peat.

Peat is the term applied to a dark brown and black, sometimes fibrous substance, derived from the accumulation and slow decay of vegetable matter under water. It is most commonly formed by moss and other marsh plants which thrive in moist, northern, temperate climates.

This moss forms around the edges of ponds or lakes and spreads towards the centre, forming a floating mass of vegetation, which may eventually cover the water completely.

As the plants die off at their lower extremities, new shoots are sent out above from the living parts, so that the plant growth increases in thickness, and the entire pond or lake may become

filled up, forming a bog. The growth of these peat-forming plants is from one to four inches per year.

In our state, where ponds and lakes are numerous, as might be expected, due to the fact that the surface deposits are of glacial formation, the peat beds or bogs are plentiful, and large; their depth often being over thirty feet while ten feet can be said to be the averag.

Clay is generally found underlying the peat, and often marl, a material from which cement is being manufactured, especially in Michigan. Sometimes iron ore is covered by these peat bogs, as proven in Minnesota.

Location.

The biggest peat bogs are located in the everglades of Florida; while North Carolina, New York, New Jersey, the New England States. Quebec and Ontario, Indiana, Illinois, Iowa, Michigan, Wisconsin, and the eastern part of the Dakotas have numerous peat-beds. So has Minnesota, and probably more than any state mentioned except Florida.

Exact figures are not available at present, but it is estimated that in the United States there are over 36,000 square miles or practically 24 million acres of peat bogs, of which possibly one million acres are in Minnesota, located mainly in the northeast corner of the state, bounded by Lake Superior on the south and the Canadian line on the north. They are found near Grand Marais, in the Iron Range, near Eli, Hibbing, Chisholm, in the Missabe and Vermillion Ranges, in the Rainy Lake and Lake of the Woods districts, and in the northwest part of the state, especially in Marshall County. There are smaller beds in the middle counties, especially along the Minnesota & International R. R., and even right here in St. Paul, towards Fort Snelling, peat can be found in fair quantities, generally overlying the limestone formations.

But what is peat good for? How can it be used and what benefits can be derived from it?

There are three distinct ways for the utilization of peat: (1) in agriculture, (2) as a raw material in the manufacture of peat products, and last but not least, (3) as a fuel for domestic, industrial and power purposes.

For agricultural purposes, the peat soil in its natural condition is too wet to be worked and before any crop-plant can be made to grow upon it, the surface must be cleared and the water level lowered by effective ditching and drainage.

Extended observation in various parts of the country where peat soils are common, apparently indicates that after one or two crops have been taken from newly cleared peat land, grass most likely will yield good crops for a number of years until

the surface layers are disintegrated into a fine-grained homogeneous mass. Crops of various kinds may then be raised, but these should be such as can stand cold nights and early frosts without injury, and will not be greatly harmed by droughts. Some truck crops such as celery, cabbage and other vegetables seem to thrive well on well blackend peat and often yield large returns. In Europe these matter have been made the ubjects of most careful and exhaustive study by trained specialists and here in our country the State Agricultural Colleges should be called upon to determine the rational course of utilizing these peat-bogs for farming purposes.

Fertilizers.—As a fertilizer, peat or muck, has been employed for a long time by the farmers of eastern states as an auxiliary fertilizing material, either by applying it directly to the land, or by using it in connection with other fertilizers, especially in compost with barnyard or stable manure.

Absorbents.—The air-dried peat may be used to even better advantage as an absorbent of the valuable nitrogeneous liquids of stables and barnyards which are ordinarily allowed to go to waste.

Bedding.—Dry peat, if free from sticks and hard lumps, can successfully be used for bedding for all sorts of live stock. When used for this purpose, the thoroughly dried peat should be packed firmly on the floor of the stalls to a depth of 3 inches or more. If well prepared and kept clean, such a bed will last several months without renewal, furnishing an elastic and spongy standing-room which absorbs and keeps down the usual odors of the stable.

Insulating Material.—As dry, fibrous peat is a good non-conductor of heat, it may be used satisfactorily to cover water pipes in order to protect them from freezing, and it is superior to straw and similar materials commonly used by the farmers.

Peat Mull.—In Europe, peat mull or peat powder, prepared from moss or sedge peat, has been used as the basis for the preparation for certain kinds of stock foods, the chief ingredients of which are the residue or molasses from beet sugar factories and which on account of their stickiness and liquid condition, are difficult to feed.

Packing Material.—As a packing material for eggs, fruit and vegetables, for storage in bins, cellars, or other receptacles, air-dried peat can be used to advantage, since because of its non-conducting properties, it will keep an even temperature and prevent freezing; but it should be understood that perishable articles packed in ths materal will not be absolutely protected from decay.

The conclusions drawn for agriculture are, that peat land may be profitably cultivated, if the right crops are chosen, and even poorly decomposed peat can be used in many ways on the farm to increase the fertility of the land and to add to its productiveness by absolutely saving valuable waste matters which could not otherwise be kept.

II. Industries.

In the United States, potentially valuable products have been lavishly used or have gone to waste because they seem to have no commercial value; and it may be said that even better materials than peat, for some of its proposed uses, are at present wasted in large quantities in or near the peat-bearing parts of this country.

As a raw material, peat can be made an important factor to build up a variety of factories, and the chemical by-products which are derived from its destructive distillation, when used as a fuel, are the most valuable assets.

Ammonium Sulphate.—Ammonium sulphate can be obtained by a process invented by A. Frank and N. Caro, both of Germany. The demand for this product is increasing because of its high value as a constituent of the best fertilizers.

Nitrates.—Nitrates of great value and in considerable quantities are also obtained in Europe by a simple process, which may prove successful from a commercial standpoint and which presents possibilities of greater importance in view of the rare occurrence and meager supplies of these salts, so vitally important in agriculture.

Alcohol.—It is reported from Denmark and France, that ethyl or grain alcohol has been made from coarse, fibrous peat. The alcohol thus obtained is concentrated by distillation. The process is an old one and is possible with any vegetable matter containing cellulose, but so far it has not met with a commercial success, and the fact should be noted that raw materials much better suited for the purpose than peat are annually wasted in great quantities in the United Staes.

Paper.—Peat which contains much fibrous matter, has been manufactured into paper and box-board, chiefly in a single factory established for the purpose at Capac, Mich.

Woven Fabrics.—The strongest fibres from the more fibrous kinds of peat, may be separated and cleaned from the surrounding material and after treatment which renders them pliable, they can be woven into fabrics for blankets for horses and other live stock.

Artificial Wood.—A material called "Heloxyl" or artificial wood, closely resembling heavy paper, is made by compressing and hardening fibrous kinds of peat into sheets, blocks or other

forms for structural purposes. This peat-wood is light, compact and water-proof and a non-conductor of sound, vibration and heat, and can also be made fireproof. It is readily glued, nailed and painted and makes good finishing material.

Mattresses.—Selected moss-peat, thoroughly cleaned of sticks and other coarse matters, is made into mattresses in Germany. The absorbent, deodorizing and antiseptic properties of peat, make these mattresses especially valuable for hospitals, for they are light of weight, resilient, soft, inodorous, and very cheap, so that they can be renewed at a very nominal cost.

Moss Litter and Mull.—A much more general use for the more fibrous kinds of peat, in Europe, is for bedding for stock, as pointed out already. At the present time a considerable amount of this material is imported from Holland and other northern European countries. It has been manufactured here in the States for several years at a single factory at Garrett, Ind., and the demand for this product is rapidly increasing.

Other products, such as packing material and fertilizer filler, which have been mentioned before, can also be profitably manufactured from peat. There are already about twelve plants established in this country, which manufacture peat-fertilizers.

The conclusions drawn are, that peat is avaliable here in Minnesota, for any of the uses cited above, although for making the more complicated products, such as chemicals, it will be wise to thoroughly investigate the methods of manufacture before building because a large investment of capital is necessary to conduct this business on a commercial basis.

The simpler products, peat-litter, mull, mattresses, packing, and fertilizer filler, have a much greater chance of being made profitable quickly.

II. Peat as Fuel.

And now comes the most important and interesting chapter namely: "Peat as Fuel."

About five years ago, Mr. James J. Hill foresaw the importance of this material, of which there is such an abundance, especially in the neighborhood of the iron ore mines of our State, and in order to be thoroughly informed as to the practicability, reliability, and commercial features of the manufacture of such fuel, in connection with iron and puddling furnaces, he spared neither time nor money to send the speaker to Europe to study and analyze the peat situation there, and report upon the phases of this class of fuel. The report was satisfactory; and later it was shown that the peat found north of Duluth could be utilized as a valuable fuel for all purposes. We have to thank Mr. Hill, therefore, for the following lecture on this subject.

Before going into details, the whole fuel situation in the United States should be reviewed. Many present here tonight

will remember Mr. Hill's address, made at the State Fair in 1906, in which he pointed out, that according to dependable authority, our main available coal supply will not give more than a century of life. After this has been consumed, the fuel will have to be obtained from deposits of low quality or at great depth, or from points remote from where it is most needed. It will be high in price so that its economic employment on existing terms will be difficult. According to reliable records, the yearly coal consumption of 1905 reached 350,000,000 tons, which, since that time has been increased to 420,000,000 in 1907, 450,000,000 tons in 1908 and nearly 500,000,000 tons in 1909. Not taking into consideration the newly discovered coal fields of Alaska, of which, so far, no data as to their extent are on hand, the coal consumption at the rate of 500,000,000 tons per year will exhaust our national supply in less than seventy years; surely a comparatively short span of life.

Is it not, therefore, time to conserve or preserve this resource which Nature has created?

There are several ways in which this can be done, the most prominent being that of economy, which means the stoppage of all waste. To cite an instance: The railroads of the United States used 90,000,000 tons of coal in their locomotives during the fiscal year of 1908-09, of which 47,000,000 tons, or 52 per cent of the total coal consumption, were lost by radiation, incomplete combustion, cinders and the escape of gases of high temperature. With absolute certainty it can be stated that these losses can be reduced from 52 per cent to 20 per cent. Similar conditions exist in industrial plants and even in our homes, though the losses here do not reach the above amount.

The time will also come when coal exports to foreign countries will be prohibited, an example of which was furnished in Germany in 1905, when, by special order of the Emperor, certain miners had to cancel contracts for coal to be delivered to foreign railroads in order to keep the coal supply for the Empire. The German Government paid the forfeiting monies to both contracting parties.

The people of northern Europe have been forced by natural and economical conditions to make progress in methods of preparing peat fuel and of using it in the most economical way, long before a similar need was apparent in the United States. Much can be learned, therefore, from a brief resumé of the latest stages of the development of the commercial use of peat for fuel in Europe.

The first thought in regard to peat, as fuel, is its use for domestic purposes, such as cooking and heating in private houses, and this, until within a comparatively short time, has been its chief use in the northern European countries, where

the common people have used it from the very early times. In some old archives, this fuel material has been mentioned at the time the Knights Templar went forward against the Turks in the Crusades of the 13th century.

The theoretical value of peat is between good wood and good coal, but because of the small waste in ashes, cinders, clinkers, and smoke, its value is doubtless near, if not equal, to that of many kinds of coal used for domestic purposes. For heating, when air-dried, it has a value of five-eighths of the best bituminous coal.

The methods most in use for preparing peat for common fuel, are:

(a) To cut it with special spades into blocks or bricks and air-dry these by exposure to wind and sun. This is called "Cut-peat."

(b) To dig it, grind, and press it into bricks by machinery, and air-dry these by air and sun. This is called "Machine-pressed peat."

(c) Dry peat powder made under high pressure into so-called "Peat-briquettes" without any binding material, are now manufactured here in the United States and Canada. These briquettes are more compact than the machine peat, have a higher heating value and can be manufactured at about $1.50 per ton.

(d) All three kinds of peat fuel, cut, machine, or briquette, can be used, besides for domestic and industrial purposes, also for producing fuel and power gases, generated in a simple and inexpensive furnace or so-called gas-producer, in which also, some of the by-products of peat, such as tar, and ammonia, can be recovered. Tests made by the United States Geological Survey, show that the gas produced from peat is richer in heat units that that from coal with the exception of one kind, mined in West Virginia.

Peat-gas as a fuel, has been used in furnaces for making glass, cement and firing pottery and building bricks, in the northern part of Europe, for the last 40 years. To obtain the required high temperature of 4000 degrees F. necessary to fuse the glass materials, the gas is thoroughly mixed with hot air before it is conducted into the combustion chamber, in specially constructed chambers underneath the furnaces.

There is no doubt that in the near future similar plants will be established in or near peat bogs in the United States, and there is no reason why it should not be done right here in Minnesota, where there are all kinds of raw material, such as clay, glass-sand, and limestone.

It was not until late in the 19th century that the gas-engine came into common use, and although many types have been de-

vised within the last 20 or 30 years, it is only within the last 8 or 9 years that large gas-engines have been constructed. This development started 11 or 12 years ago in Germany, Belgium and England, but marked progress has been limited to the last 8 years. This rapid advance of the large gas-engine was made possible by improvements in the production of cheap gas directly from fuel, by means of the gas-producer.

Gas from Peat is the cheapest so far produced, because in one hour, 100,000 to 130,000 cubic feet of gas are generated from one ton of air-dried peat; and as only 90 to 100 cubic feet are necessary to create one horse power for one hour in a gas-engine, the cost per horse power for one hour will be less than one-fifth of one cent, if no by-products are saved, but if the by-products are recovered and utilized, then the cost of the power is potentially nil, which has been demonstrated by Engineer Hornsey of New York.

The cost of such power, if converted into electricity, will, therefore, be less than $15 per horse power per year, which is one-half of the cost of any water power than can be developed in this state; and the manufacture of nitrates by the process of Birkeland and Eyde of Norway, in which by the introduction of great quantities of electrical energy, the atmospheric nitrogen, the natural fertilizer, is combined with oxygen, can be accomplished by this cheap power.

The great amount of power which could be developed by gas generated from peat, can be expressed in the following figures:

One acre of peat of one foot depth, will yield 250 tons of air-dried peat and as has been already stated, the depth of the peat-bogs is not less than ten feet, therefore the total output per acre will be 2,500 tons of air-dried peat. This converted will give 2,500,000,000 cubic feet of gas per hour which at the rate of 100 cubic feet will develop 25,000,000 H. P. hours or little over 2,800 horse power per year.

As estimated, there are 1,000,000 acres of peat-beds in Minnesota, which then could furnish 2,800,000,000 horse power for the year or 1,000,000 horse power for 2,800 years. These are enormous figures in comparison with the water powers so often referred to recently, in the convention on deep water-ways; and the immensity of this comparison can hardly be grasped by the human mind.

(e) And last but not least, peat can be converted into coke, in ovens or retorts of different design and construction than those used for making coke from coal. In this process, which was invented by the German engineer, Ziegler, not only are all valuable by-products recovered, but the gases which cannot be condensed, are used for firing the ovens. The dried peat blocks

or briquettes are fed into the top of the ovens and the finished coke is drawn off at the bottom, making the operation a continuous one. The main by-products recovered from the condensible gases are tar and tar-water, from which are distilled different chemicals. The tar, high in creosote, can be used directly for treating timber, but it is generally converted into light oils for illuminating purposes, heavy oils for lubrication, paraffine, raw carbolic acid, and asphaltum. From the tar-water the following can be extracted: wood alcohol, acetate of lime, used in the manufacture of aniline dyes, and sulphate of ammonium, which latter one is the most important. The market value of these by-products assists in reducing the cost of this peat-coke so much, that in large plants, the cost of first class peat-coke will not exceed $2.50 per ton, while, when manufactured in smaller scale, the price will be increased to $3.00 per ton. Coke made from coal, commands a price of from $5.00 to $7.00 per ton here in Minnesota.

From three tons of air-dried peat briquettes, one ton of first class coke or one and one-half tons of second class coke can be obtained.

The first class peat-coke has a greater heat value than our best coke, manufactured from Pennsylvania coal at Connelsville and equals charcoal, the latter costing from $12.00 to $14.00 per ton. In Germany, Russia and Sweden this coke has been made by this process during the last 8 years and it is used in iron manufacture and other metallurgical processes, including copper refining and steel making, for which its freedom from sulphur and phosphorus renders it especially valuable.

Since he received the information regarding this peat-coke process, Mr. Hill has always maintained that pig iron of a quality of charcoal iron and of a better grade than that manufactured by any plant in the United States, could be manufactured cheaper in Minnesota than in Pennsylvania or Alabama, and he expressed himself to this effect before the State Legislature about a year ago. And why shouldn't this be so?

The freight on iron ore from the Minnesota mines to Pittsburgh is $2.50 per ton, and as two tons of ore are necessary to obtain one ton of pig iron, the saving in freight alone would be $5.00. Limestone used as a flux for smelting ores, can be found plentifully within 150 miles of the mines, and the coke made from the peat-beds located next to the iron ores, would cost from 65 cents to $1.00 less per ton than any coke obtained from coal at or near Pittsburgh. The cost of the production of a better grade of pig iron than that now made in Pennsylvania will then be decreased about $6.00 per ton.

The present price of pig iron at Birmingham, Ala., is $14.00 per ton and laid down here, $19.75, while when manufactured

near the iron ore region with the aid of peat-coke, the cost will possibly be $8.00 per ton, but surely will not exceed $9.00.

The total output of iron ores in the United States during last year was 51,000,000 tons, of which 27,000,000 tons were furnished from Minnesota. It is expected that this year 30,000,000 tons will be shipped from here. From all the iron ores, 25,500,000 tons of pig iron were manufactured last year.

Again let figures show the magnitude of this fuel resource in our State:

As before mentioned, one acre of peat with a depth of 10 feet, will yield 2,500 tons of air-dried peat. This converted will give 833 tons of first class coke; 1,000,000 acres will, therefore, furnish 833,000,000 tons of coke, with which 800,000,000 tons of pig iron can be manufactured from 1,600,000,000 tons of iron ore, which, as far as known, Minnesota can supply. But taking the output of iron ore in Minnesota as 30,000,000 tons per year and continuing this amount yearly hereafter, the coke which would be made from the peat in our State would suffice to convert this iron ore into 15,000,000 tons of pig iron per year for over 50 years. The value of this product at the present local price of $19.75 per ton of pig iron, is then $296,250,000 per year, which is nearly $100,000,000 more than the estimated value of Minnesota's whole crop of wheat, corn, barley, rye, flax and potatoes during the last year.

On the other hand, assuming that instead of using the peat-coke for the manufacture of pig iron the 1,640,000,000 tons are put to other purposes and are marketed at $3.00 per ton at the coke ovens, the value represented will then be $4,920,000,000.

The time has come for the people of Minnesota to wake up to the fact that there are immense quantities of valuable materials lying idle and action should be commenced by our State government to at least locate and examine these peat deposits, seriously and systematically, as has been done in other states, and ascertain the supply of fuel which, when known, will surprise many and which should be made an important addition to the natural resources of our State, wealthy with other raw materials but deficient in coal and other kinds of mineral fuels.

In the foregoing the fuel supply which can be created from our peat bogs, is shown to have such enormous quantities and wealth that in the minds of many of you the questions will arise: Why has there been no tendency on the part of the iron mine owners and steel manufacturers to avail themselves of the benefits of this, our natural resource? What are their reasons for ignoring opportunities which nowhere else exist? These questions I cannot answer, because I do not know. It seems, therefore, that it is up to the people of Minnesota to devise ways and means by which iron and steel and other industries can be in-

duced to locate here, which not alone will benefit our people at large, but which will ultimately make Minnesota one of the greatest iron and steel manufacturing states of the Union.

Will we meet this great issue honestly and conscientiously? The answer lies with you, the people of Minnesota.

MULTUM IN PARVO.

The Peat Engineering Co., Toledo, O.

So much has been published in this Journal relating to the methods employed in Europe for manufacturing peat fuel, that it is not necessary to go into further detail regarding them at this time.

The machines manufactured by R. Dolberg, C. Schlicheysen, A. Heinen, L. Lucht, A. Anrep, Ackerman, etc., are all "wet process" machines, but they all require so much manual labor to excavate the raw peat and spread the machined peat on the ground, that they have not come into general favor in this country. Ninety per cent of the peat fuel made in Europe is made by these machines and the machined peat is in almost every instance dried on the bog.

It is well to remember that none of these machines are built to extract any of the moisture contained in the raw material, but to so treat the peat that when it is exposed to the sun and wind, drying takes place by their action.

In some instances stationary plants are erected, to which the raw peat is carried in cars, dumped into the mill and carried therefrom on boards, or other cars, to racks, sheds or other costly contrivances to facilitate drying. By this means there are two separate handlings of the material, one in its raw condition, the other after machining, which, while reducing the bulk, does not reduce its weight. No plant employing artificial dryers, racks, sheds or other pallets on which to dry the peat blocks has continued to operate after the money raised by the sale of stock was exhausted.

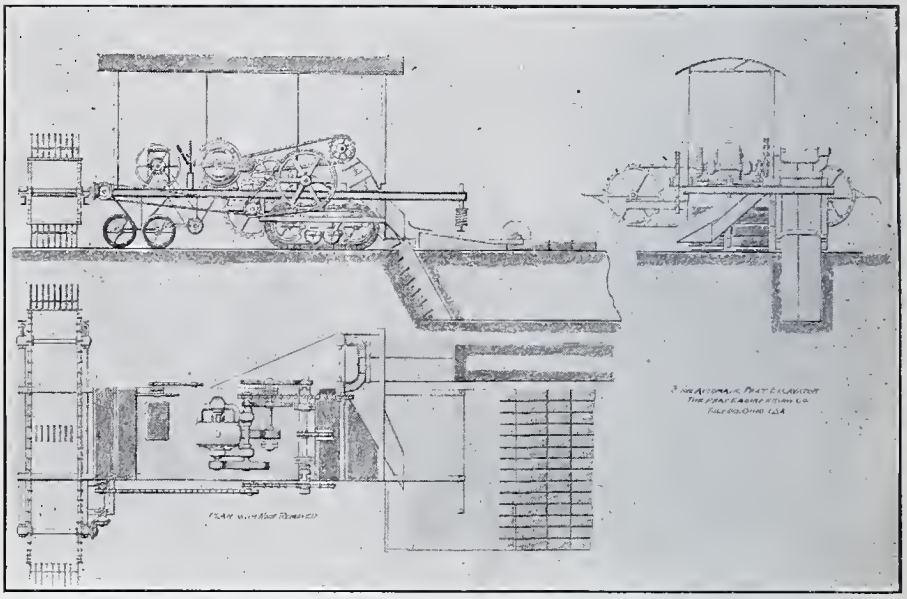
It may not have occurred to many why most European peat fuel is dried on the bog and not by any of the means above mentioned. The quickest, cheapest and most efficient means to get rid of at least twenty-five per cent of the moisture in the bog is to drain the bog by approved methods and not dig all the peat out of one hole without giving the deposit time to drain and consolidate.

When the peat blocks have laid on the bog about one week, according to European practice, they are placed into little piles of six, crossways over each other; then these piles are put two into one when dry enough; later they are carried away and

stacked in a suitable location. All the above is done by hand, but the high cost of American labor precludes any such primitive means.

To make peat fuel in this country at a cost that will admit of its sale at a profit in competition with coal and wood, all the excavating, macerating, spreading, and windrowing, must be done mechanically; transport of the wet peat must be eliminated, the bog must be drained, and the output of fuel must be large, for the amount of money invested.

All of these important and desirable features are embodied in, and brought about by, the "Portable, Automatic, Trackless, Peat Fuel Machine, and Harvester."



This machine consists of a steel car mounted on two sets of wheels, the rear, or driving set, being provided with apron attachments to distribute the weight over a large area, the forward set being in the form of a truck, pivotally mounted to facilitate steering. On the platform or deck of this car is placed a steam, gasoline, or electric motor, which furnishes power for excavation, maceration, spreading, and windrowing. At one side of the car is mounted a double, circular casing, in which revolve two spiral conveyors, intermeshing with each other and having an adjustable, detachable, saw-tooth periphery, which cuts the peat out of the bog in fine particles and, while elevating it to the deck of the machine, macerates and condenses it, and liberates the air, afterwards delivering the mass to a slide, which drops it on the bog, near the edge of the drain from which it has been taken.

Connected to the rear of the machine, is a steel spreader,

PENNSYLVANIA

which evens off the peat to a given thickness, and cuts it into parallel rows, which are later cross-cut by a suitable hand tool.

The secret of successful peat fuel making lies in the excavation and treatment of eight cubic yards of raw peat, to produce one ton of hard, dense, dry fuel, thus eliminating 90 per cent of the water contained in most virgin bogs, down to 75 per cent or to 15 or 20 per cent in the finished fuel, at a minimum cost.

The place to begin on this elimination is in the bog, by means of trenches, or drains placed a suitable distance apart, deep enough to be effective, and run with the fall of the ground.

The automatic machine described, travels under its own power over the bog, and cuts a trench, using the peat taken out of the trench for fuel making.

Its average forward speed is three feet per minute or 1,800 feet per day. At end of first day's run the machine is turned around and operated on the opposite side of the trench to the one on which the peat is laid out to dry; at the end of the second day's run the machine will be at the point originally started from, which should be at the lowest point of bog. Another trench is then cut about 100 feet from first one, the peat laid out on both sides in same manner, and so on, trenches being dug and the excavated portion macerated and laid out to dry on the edge of the trenches.

After a few days, the peat laid out on the edge of the first trench dug, will be dry enough to put into windrows. At the front end of the machine is a device which scrapes the partly dried peat blocks over to one side, away from the trench, and piles them into windrows, at the same time the machine is taking its third section, or cut, off the side of the trench first dug; the operation is continued till the machine gets to the last trench of the series first dug, then returns to starting point.

The windrows, meantime, are pushed towards the center of the 100 foot strip, and constantly turned over, which greatly assists in drying the peat.

The peat is not touched by hand until it is ready for storage, or market, at which time, (about two to three weeks after excavation,) it is loaded into wagons or cars on portable rails, running between the windrows.

The mechanical devices used in the machine, are the result of experience gained while operating European machines; the construction and design is the result of the work of expert peat engineers; the material used is the best money can buy: the ultimate result is a machine built by brains, backed by experience, skill and honesty of purpose.

The machines are at present built in three sizes, having an output of one, three and five tons of peat fuel per hour, respectively.

These machines were designed with two objects in view, the preparation of peat for fuel purposes, and for further treatment for fertilizer filler.

The cost of either fuel or filler stock, made by this process is about 78 cents per dry ton.

THE PEAT AND MUCK LANDS OF NEW YORK.

M. Earl Carr, B. S., U. S. Department of Agriculture, Bureau of Soils.

(Read at the Syracuse Meeting of the N. Y. Section.)

Soils are generally supposed to be composite mixtures of inorganic and organic materials capable of furnishing a habitat and sustenance for plant life, where climatic and other conditions are favorable. However, varying in both directions, we have soil materials which are extremes, according to the definition given.

There are soils, or perhaps it would be better to say soil forming materials, which are made up almost exclusively of inorganic or mineral matter; matter not organized by life, with a minimum of the organic constituents, matter formed by processes of life. A conspicuous example of this character of soils are the pineapple lands of Florida. These lands consist of a soil made up of almost pure white sand. Soils of this extreme character are able to produce crops only by heavy fertilization, but are none the less soils, for they furnish the home for the plants during their process of growth and development. They furnish the medium for holding the growing plants upright, that they may receive the benefits of the sunlight and thus elaborate crude material into living tissue. These soils have their counterpart in New York State in the coastal beaches of Long Island, but they are not in this case agricultural soils on account of climatic influences.

The antithesis of these inorganic soils, the other extreme, is found in the peat and muck soils, which are soils, or soil forming materials, composed almost exclusively of organic matter with a minimum of the mineral constituents. Material of this character can also be classed as a soil, for it, too, furnishes a home for plant growth, a medium for holding plants upright, that they may develop and mature, as does the other extreme.

However, neither of these classes of soil-forming material can be called a complete, a finished soil. All soils were originally of one or the other of these two classes of material. When the rocks of the earth were first lifted above the sea and the activities of weathering first began their work of softening and loosening the solid mineral material there were no organic constituents, and all soils formed in that way were in their primi-

tive state of the first mentioned class but no soonr had the process of soil-formation begun than the lichens, the lowest order of plant life appeared and organic matter was supplied to the forming soils by their growth, death and decay. Animal life also appeared and contributed its quota of the organic constituents in the process of the formation of soils.

On the other hand, in not a few places on the crust of the earth there were left or have been formed shallow bodies of water, in which various forms of aquatic plant life began to grow, the decay of which formed crude organic soil material which has since and contemporaneous with its formation been altered to a greater or less extent by the addition in various ways of inorganic soil constituents.

Thus we can consider both of these classes of soils as being made up or formed of crude, soil-forming materials. In other words they are "primitive" or "raw" soils, and the popular conception of a soil, is a composite mixture of the two.

In the discussion of the agricultural possibilities of peat and muck soils, a division of the material into two parts should be made, true peat, or the remains of plant growth but little decayed and containing a small admixture of the mineral soil-forming materials, and muck, the muck being a more advanced stage of decay of the organic plant materials, and often containing a considerable percentage of the inorganic materials. There is no sharp line of demarcation between the two, the one grading into the other. For agricultural usage other than the direct production of crops there is no great difference in value, but for the growing of domesticated crops there is a considerable difference, as is attested by resulting yields and success.

The peat proper, being more fibrous, is likely to be too loose, light, and droughty for profitable crop production, and, besides, organic matter in this condition, or stage, of decay, tenaciously holds moisture to itself, not being able to deliver it to growing crops as rapidly as it is needed by nature in constructing the plant tissues. On the other hand, the more thoroughly decayed organic matter—muck—not only retains a larger quantity of the moisture received, but is able to give it up to the growing plants more readily.

For indirect agricultural uses there is no great difference in value, though in many instances the peat is probably preferable. As it is more fibrous and retains moisture better, it makes a better absorbent than the muck, and therefore is better in compositing, better as a litter in stables, and should make a better "filler" for fertilizers.

Either of these forms of organic matter is valuable when used as a top dressing on soils having a low organic content, since either acts as an aid to nature in the process of rebuilding

a complete soil or restoring the necessary organic matter. Contrary to the somewhat general belief, these soils or soil materials, do not possess a large amount of the commonly supposed plant food elements, and it is not likely that any great benefit is derived from their use for fertilizing purposes alone. They do have, however, a decided beneficial effect in other ways. Let us consider for a moment the influence of organic matter on the moisture-holding power of the soils. A sharp, clean sand, after being dried in an oven, will hold 25 per cent of its weight of water; a loam, 51 per cent; a garden mould rich in organic matter, 89 per cent; and humus, pure muck, 181 per cent. Thus it is seen that at least one of the chief functions or benefits resulting from applying muck or peat to a soil is in increasing its power to hold water.

Now moisture is held in a soil in two forms, free or space water, which is not used by the growing plants and if much in excess is inimical to their growth, therefore the necessity for and beneficial effects of underdrainage, and film water, the water held as a coating outside of the soil grains. This form of water in the soil is the dilute solution from which the feeding rootlets of the plants secure the nutritive plant foods for their growth and development—in fact, this is the beneficial soil moisture. Let us notice what effect organic matter has upon the amount of film water a soil may contain. A coarse sand will contain from 12 to 15 per cent of its weight of film water, a sandy loam 20 to 30 per cent, a clay 30 to 40 per cent and a heavy clay or soil rich in humus, organic matter, 40 to 50 per cent. Thus we see that organic matter not only enables a soil to retain larger quantities of water, but makes it capable of maintaining a larger amount in a form useful to plant life.

Another beneficial effect of organic matter upon soils is in improving their physical condition. A soil which has a low organic matter content is likely to have a poor structure if it is not a sand or sandy loam. To such soils an application of peat or muck as a top dressing can have no other than a decided salutary effect in making its physical condition more favorable for the growth and development of field crops.

Then again, the activities of a low order of plants, the bacteria, in a soil, are essential to its productivity, and they thrive best when there is a good organic content in the soil.

In the soil survey work of the Bureau of Soils of the United States Department of Agriculture, muck and peat soils have been mapped to the extent of 1,216 square miles, or 778,-771 acres, of which 82 1-5 square miles, or 52,608 acres, are in the State of New York. In the Syracuse area, which covers the Syracuse and Baldwinsville quadrangles of the United

States Geological Survey topographic sheets, there are mapped 16,960 acres of muck and 12,480 acres of swamp, which is for the most part muck. In the Madison county area 18,944 acres of muck are mapped, or 4.6 per cent of the total area of the county. In other areas, which have been surveyed the acreage is not so large, though in many cases these soils are highly developed and are the highest priced agricultural soils of the region.

As to the practical utilization of the muck and peat soils in the production of crops, let us first consider, not their possibilities, but their actual utilization for agricultural purposes.

In Madison county, what was formerly the Cowaselon Swamp, an eastward extension of the Cicero Swamp of Onondaga county, has been partially reclaimed and a portion if it is intensively cultivated to specialized forms of agriculture. The soil here varies from a true black muck to a form about half way between muck and peat, and is usually underlain by a deep subsoil of calcareous marl. Where this land is extensively cultivated, rows of trees have been set around the fields as wind breaks, because the peaty soil upon drying out becomes very light and is easily blown away by the wind or blows over and covers up the young plants. A comparatively small percentage of this large area of valuable soil is under cultivation, but where intelligently and carefully managed and crops grown to which the soil is adapted, gratifying results have been obtained. The crops grown are chiefly late celery and onions. Yields of these are: Celery, 1,000 dozen "ones" of first quality, with about half as much of inferior quality; onions, from 400 to 800 bushels an acre. The gross returns an acre from each of these crops varies from $150 to $250 an acre, while the cost of production averages around $100 an acre, leaving a net profit of from $50 to $150 an acre. One man, who cultivates seventy acres, says he never expects to clear less than $100 an acre each year.

Before drainage was afforded for this land it was valued at about $3 an acre. Immediately after the first attempts at drainage there was an increase in valuation of 500 per cent, or to $15 an acre. Three years ago, cleared land in this old swamp was held at $125 and more, and uncleared at from $40 to $50 an acre the increase in valuation for the uncleared land being 1,500 per cent and for the cleared over 4,000 per cent.

The drainage of this swamp was not primarily attempted for the agricultural development of its soils, but for taking care of the large volume of water occasioned by the emptying of the sixty-mile level of the Erie canal. However, it has resulted in increasing the valuation of the agricultural lands of the county by approximately $500,000. The level of the surface

of the bed of this former swamp has an elevation of 386 feet above the sea, while the level of Oneida lake, a mile distant, at the nearest point is 370 feet, giving a fall of sixteen feet, which is sufficient to drain the whole area completely and efficiently and make actual and profitable agricultural occupation possible. The drainage of the Cicero Swamp does not present any more difficulty than has been overcome in connection with this old Cowaselon Swamp.

In the Livingston county area, a small muck swamp, containing only 640 acres, has been drained strictly for agricultural use and is now in a high state of cultivation. The crops grown on this land and several other smaller areas which have been drained and reclaimed are principally head lettuce and early celery with some onions, carrots and spinach. Yields are as follows: Lettuce, 500 baskets of 30 heads each an acre; celery, about 2,000 dozen an acre; onions, an average of 400 bushels an acre, though 1,300 bushels have been secured; carrots, 20 tons an acre; spinach, three crops of eight tons each an acre. The average gross income an acre from these South Lima muck beds varies from about $70 an acre for the carrots to nearly $500 an acre for the spinach, with the income from the lettuce and celery near the upper limit.

Before being drained about twenty years ago these swamp lands were considered worthless, and would not be accepted in payment of even bad debts. Now, however, they are by far the highest priced lands in the county, being held at $400 an acre, while sales have actually taken place at $350 an acre, and fields rent for from $20 to $50 an acre by the season. The increase in valuation for this small area is nearly $200,000.

As a matter of comparison of the esteem in which these soils are held, let us look at the prevailing prices of other soils of the county. The famed "Genesee Flats," along the Genesee river, classed as Genesee silt loam, are held at from $125 to $150 an acre, and farms of the Volusia soils, in the high hill country of the southern part of the county, are offered for sale for $8, $10, $12 and $15 an acre. At the time these swamp soils were considered worthless, these same hill soils were selling for from 300 to 500 per cent above their present price.

Near Arkport, Steuben county, five hundred acres of this muck land is under cultivation, celery and lettuce being the crops grown. Before being cleared and drained this land was worth about $2.50 an acre. Today the cleared and cultivated portion is worth $300 and the uncleared $100 an acre, an increase in valuation on the five hundred acres of about $150,000.

A man in Genesee county owning some of this land says

that it was assessed at $10 an acre before he tried to do anything with it, and that he always "kicked" at paying taxes on that assessment, as he considered the land worthless, but that now he can easily rent the land out by the season at from $15 to $20 an acre. However, he does not consider that any object, as he can make it pay him much better than that in producing celery, onions, lettuce and spinach.

All over the state we can find many places where the story of the drainage and the utilization of these soils is the same—increased value, big crops, etc., in almost every case.

In the utilization of these soils the question of fertilization is important, as it is with all soils. We often hear it stated that such soils are so rich that they never will need to be fertilized, but experience has demonstrated that this is not the case. So far as observation goes the first three crops can be grown without the use of fertilizing materials, but that succeeding crops are not successful without fertilization of some kind. Wherever these soils are extensively and intensively cultivated large quantities of high grade commercial fertilizers as well as stable manure are always used.

The agricultural possibilities of these soils are great. Thousands and tens of thousands of acres of them in the State of New York are lying undrained, uncleared, a breeding place for mosquitoes and malaria, and our cities are consuming daily large quantities of food products grown many hundreds of miles away, on soils identically the same in character.

Let us consider the drainage of these muck and peat sawmps as a means of increasing the wealth of the state. Accepting the estimate of two million acres total area as correct, and then, to be conservative, regarding only one-half of this area as suitable for crop production, letting our friends, the fuel experts, have the other half; and then, to be still more conservative, taking it for granted that only one-half of this, or one-fourth of the total area, can be eaily and successfully drained, we have five hundred thousand acres. If we assume that in its undrained condition it is worth $10 an acre—much of it is worth considerably less— the total present value is $5,000,000, and from this there is practically no income. Assuming the cost of drainage and clearing to average $40 an acre—there are many acres which have been drained and cleared for less—we have an initial cost of $50 an acre, or $25,000,000 for land which is conservatively worth from $50,000,000 to $100,000,000. Is it worth while?

A NEW PROCESS FOR COKING PEAT.

W. L. Shepard, Elmwood, Conn.

(Read at the Boston Meeting.)

At the outset, a brief history of the work of The Holding Peat Fuel Company may not be out of place as it will show that whatever we have to say is backed by actual experience and not altogether by book knowledge.

Being believers in peat and its possibilities, we started in to solve its mysteries some fifteen years ago; our mistakes were many in the beginning, for we had to advance by our own experiments, for in those early days we had no experience of others to follow.

First, we started in to manufacture briquettes, both in combination with other material and from peat alone. This we found to be impracticable, as they are not a fixed fuel, and would not stand the effects of heat and moisture, (going to pieces in the fire.) The odor which they gave out while burning also condemned them as a household fuel.

Second, we found that a much better fuel could be made from condensed peat, than from compressed; that not over 40 per cent of moisture should be taken out, and that this should be taken out before it is condensed by grinding, as this process frees a large amount of the chemical substances necessary to the production of a hard, solid fuel, rich in carbon.

Third, we then brought out a condensing machine which was the second machine ever invented for this purpose; this machine enabled us to produce condensed peat bricks, which were more weather proof and cost less to produce than the compressed briquettes, but they emitted the same disagreeable odor in burning, which barred them also from being used as a household fuel.

Fourth, our next forward step was made in bringing out our open coking retort, which enabled us to carbonize the condensed peat bricks, and we were given the credit of producing the first carbonized peat fuel in a commercial way, in this country, and have gone on record in this respect.

Fifth, in running this open retort, we discovered that we were losing at least fifty per cent of the real value of peat, in the escaping gases; this led up to our inventing the externally-fired closed retort with which we were enabled to save all of the gases, and convert them into various by-products, which increased the profits of our process at least 50 per cent; this was a great improvement over the open retort.

Sixth, we were finally crowned with complete success by bringing out our closed, internally-fired retort, which is lined inside with fire-proof material, and cannot burn out. A much

higher temperature can thus be had, which enables us to make a much harder fuel and more gas, richer in carbon.

Seventh, with our process we have also practically overcome the great difficulty of drying-out peat, as we can handle it with some 40 per cent. of moisture in it, with our internally fired retort, and it can be reduced to this per cent. of moisture readily by the use of the waste heat from the retorts, when 30 per cent. of water is taken out the peat before condensing.

This brief statement gives only a few of the many experiments which we have made, to enable us to make up our complete process, of handling peat from the bog to its finished products, in a commercial way.

The Process for the Production of Fuel and Gas from Peat.

First, the peat is taken from the bog, by dredge or car system, according to conditions of the bog; if bog can be drained, the car system is used, if not, the dredge is the most suitable.

Second, the peat so obtained is furnished to our water separator by belt conveyor, and this machine takes out 30 to 40 per cent of its free moisture.

Third, it is then conveyed to condenser by belt conveyor, which is placed on the second floor directly over tuber, and is condensed to one-third of its original bulk.

Fourth, it drops by gravity from condenser to tuber, where it is tubed into hollow cylinders of suitable size and lengths, and is caught on pallets, which are stacked on cars of suitable size to hold at least 3,000 pounds.

Fifth, the cars are then run into drying tunnels, where the peat is dryed by the waste gases from our retorts, until it does not carry over 30 per cent. of moisture.

Sixth, the dried peat is then conveyed by car and elevator to the top of carbonizing retorts, which are charged with dry peat as often as required, the cars when emptied are returned for fresh loads of wet peat.

Seventh, the retorts are heated up to 3,000 degrees F. and then charged with dry peat, the lids placed on, and the process of driving out all volatile matter begins; this requires from two and one half to three hours time, according to the hardness of fuel required.

Eighth, the coke is then drawn from bottom of the retorts into cars which have close-fitting lids, to exclude the air; a chemical compound is also used in the car to smother out the fire, which requires some 8 hours time; when the cars are cold the coke is emptied into bins, and are ready for use again.

Ninth, the gases driven off in the process of coking pass out of the retorts near the top into a hydraulic main, and through this to the by-products separator, where all condensible gases are condensed and conveyed to storage by-products tank, from

which they are taken later and separated into their several products, by re-distillation.

Tenth, the combustible gases are then passed through a super-heater, in which any unfixed gas is fixed; the gas is then passed through a washer and conveyed to the gasometer, all ready for use or sale.

The results of a 100 ton, dried peat fuel plant are 40 tons of charcoal equal to 5,333 half bushel bags, and 2,500,000 cubic feet of gas, of thirty-three tons of hard coke and 3,000,000 cubic feet of gas much richer in carbon than that to be had when charcoal is the fuel product.

Some points of importance as developed by us in our 15 years of experimenting with peat are as follows:

First, that well decomposed peat is the best for the manufacture of both fuel and gas, as it carries more carbon and can be handled with less expense.

Second, that not over 40 per cent. of water should be taken out of peat and this should be done before it is condensed by grinding, as this process frees a large amount of chemical substance which goes to make up the bitumen of the fuel, which would otherwise be lost, and a light, fibrous fuel, low in carbon, would result.

Third, that condensed peat makes a better fuel than that obtained from compressed peat, more weather proof, and harder, and it can be carbonized without going to pieces.

Fourth, that the carbonizing of peat makes a fixed fuel rich in carbon, and free from sulphur and other deleterious matter, and can be made of any degree of hardness that may be required; it is superior to wood charcoal, and equals the best of coke for all smelting purposes.

Fifth, that by the use of the closed retort, all of the volatile matter of peat which is driven off during the coking process, in the form of gas, can be saved, the combustible gases for power and lighting purposes, and the condensible gases can be distilled off into their several products.

Sixth, that by the use of the internally-fired retort, we can use peat with 30 to 40 per cent of moisture in it, for the production of fuel or gas successfully

Peat to coal; by a peculiar decomposition, or fermentation of buried vegetable matter, resulting in the separation of a large proportion of its hydrogen in the form of marsh gas, (CH_4) and similar compounds, and of its oxygen in the form of carbon dioxide (CC_2) the carbon accumulating in the residue, which with small quantities of other mineral matter is coal.

The following table shows the progressive diminution in the proportions of hydrogen and oxygen, in the passage of wood and peat to anthracite

	Carbon	Hydrogen	Oxygen
Wood or live peat	100	12.18	83.07
Peat, air dried	100	9.85	55.67
Lignite	100	8.37	42.42
Bituminous coal	100	6.12	21.23
Anthracite coal	100	2.84	1.74

The difference in the composition of the several varieties of fuel above give rise to a great difference in their mode of burning; the following table exhibits the composition of representative specimens of the four principal varieties:

	Air Dried Peat	Lignite	Bituminous Coal	Anthracite Coal
Carbon	61.02	66.32	78.57	90.39
Hydrogen	5.77	5.63	5.29	3.28
Nitrogen	2.81	0.56	1.84	0.83
Oxygen	26.40	22.86	12.88	2.98
Sulphur	0.16	2.36	0.39	0.91
Ash	3.85	2.27	1.03	1.61

The above fuels under the action of heat, undergo destructive distillation, resulting in the production of the various compounds of carbon and hydrogen, some of which products, such as marsh gas, (CH_4) and Olefiant gas (C_2H_4) burn without smoke, and combustion is perfect, while others like benzole (C_6H_6) and napthaline ($C_{10}H_8$) which contain a very large amount of carbon burn with a smoky flame, and a considerable quantity of carbon escapes in a very finely divided state as smoke or soot.

In going over the above tables, it will be readily seen that peat will produce the greatest amount of gas, cleaner and more effective for fuel purposes, or, when burned in its carbonized state, will deliver as many effective heat units as most of coals, as its combustion is more perfect than coal and there is less waste of carbon.

This is why in almost every laboratory test of coal and peat the coal has shown a much larger amount of heat units, but in actual running tests, the peat has been found to equal or even surpass coal in effective heat units when properly fired.

THE PROCESS OF THE PEAT MANUFACTURING COMPANY.

By Walter J. Creamer, Bangor, Maine.

(Read at the Boston Meeting.)

The Peat Manufacturing Co., of Bangor, Me., has built and operated during 1909, a small plant and hydraulic filter press of novel design to demonstrate the commercial possibilities of manufacturing pressed peat fuel. As is well known all attempts to squeeze the water out of peat hitherto have been unsuccess-

ful. The best that has been done is to reduce the water content of the peat down to 66 per cent, but this company has found no difficulty in reducing it down to 50 per cent in two minutes time, and making firm, hard briquettes of any size and shape desired and that will stand much hard usage, that may be removed from the machine automatically and which dry out in a few days, ready for use.

It is not the object of the company to remove all the water and produce fuel ready for use; that would be impossible by our method, but we remove sufficient so that the blocks will hold together as they are carried away to the sheds where they dry out in about twenty days ready for market.

Our machine will produce about five tons daily and contains new and novel filter arrangements, and in machines of larger capacity we know of no reason why the fuel cannot be produced as low as fifty cents a ton, and be operated summer and winter alike. Our object is to eliminate the more expensive hand labor that adds greatly to the cost. The work of developing this process will be continued with improved facilities next year.

PROBLEMS OF PRODUCTION OF PEAT FUEL FOR GAS-PRODUCERS.

Charles A. Davis.

In our enthusiasm over future possibilities, we are often inclined to overlook the stern realities that arise to confront us whenever we attempt to put our theories into practice. During the past two or three years, much has been said of the use of peat as fuel in gas-producers, and we have congratulated ourselves again and again that, at last the proper way to make peat fuel a commercial success had been reached—build gas-producers and run electric plants with them, and thus convert the stored up energy in the peat to power. It is perfectly simple and easy thing to do, without doubt, and entirely practicable; in this way also the very highest value possible in heat units can be obtained from peat; but how many of us have ever made a careful estimate of the amount of peat fuel that is required to develop a hundred horse power in the form of electric energy ready for delivery, for a year?

If it is assumed that the producer gas is generated in well-designed gas-producers and used in suitable gas engine, and that the peat is of good qquality, three pounds of peat will probably furnish a single unit of power, a horse power per hour, at the switch-board; but let us assume that 3.5 pounds are needed, in order to have a sufficient amount, and it is apparent at once that the quantity of fuel used each hour for 100 horse power would

be 350 pounds, or 3500 pounds per 10 hour day. The plant is operated for 300 days, we will assume, and during that time 525 tons of fuel will be needed to which must be added that needed to keep the fires going during the remaining time, which may be estimated to amount to 100 tons more, making a total of 625 tons for the plant for the year. This is smaller than the requirement of coal for boiler purposes for the same amount of power, without doubt, so that the showing is excellent for peat, so far.

It is the procuring of the necessary 600 or 700 tons of peat as needed, and in suitable condition to use, that is the retarding factor. This again is a small matter, for a plant with a productive capacity of 50 tons per day of dry fuel, would easily turn out that amount in 12 or 14 days of favorable weather, we say, but, unfortunately for our enthusiasm, when we are asked by the owners of manufacturing plants where they can see a peat fuel plant in operation, that is making 50 tons of peat fuel per day, we can only answer "In Europe."

Herein lies the weakness of the situation for us, and here it is likely to remain as long as the total peat fuel production for the entire United States remains so small as it has been up to the present. It is essential, as has been stated elsewhere in this number to show a way by which a good quantity of reliable, dry fuel can be made, day after day, for an entire season, before men who want power for running plants which must be run throughout the entire year, at the highest rate of efficiency, will consider peat fuel as a possibility for gas production. It is not a matter of experiment simply, but one of actual doing, on a commercial basis, with plants that are well-equipped and financially supported until the men running them have gained experience and know what they have to do and how they are going to do it. They must know how to make a 10 ton plant produce 10 tons of finished product every day during the season, at the least possible cost price. It is not a question of making 10 tons once in a while to show off the plant to visitors, but of keeping the operations going at the highest speed every day during the season, and making each day a test of the utmost capacity of the plant. Until this is done by at least one plant, for which no excuses need be offered and no explanations need to be made, that it lacks this or that, it is not to be expected, or hoped, that we shall hear much of the erection of electric or other power plants equipped with gas-producers for utilizing peal fuel.

The situation at present seems to be very hopeful, that, within a season or two, perhaps this coming one, more than one small, fully equipped peat fuel plant will be operated as outlined above. May that time soon come!

Journal of The American Peat Society

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EDITORIAL NOTES.

Explanation of the Delay in Publishing.—This number of the Journal is more than a month late because the manuscript copy was completely destroyed by fire, after it had been finished and forwarded to the printer. The fire occurred in the office of the Express Company in Toledo, where the package was at the time. This necessitated the reproduction of the entire manuscript, as no copies of any of the articles or other matter had been kept; such replacement, of course took as much work and time the second time as at first. It is sincerely hoped by the Editor that delays from this cause will not be of frequent occurrence.

Annual Meeting.—The season's run for 1910, of the peat fuel plant operated by the Canada Department of Mines, will end on July 31.

As it is very desirable that this model plant should be seen in full operation by the members of the American Peat Society,

it has been decided by the Executive Committee to hold the Annual Meeting on Monday, Tuesday, and Wednesday, July 25, 26 and 27, at Ottawa. Full particulars in te July number of this Journal.

Members desiring to present papers at this meeting are requested to send titles to the Secretary as soon as possible so that the program may be made up at an early date.

The fuel testing station of the Mines Branch, Department of Mines, is situated on the corner of Division and Dolly Varden Streets, Ottawa, and can be reached by the Gladstone Avenue car, which passes through the main thoroughfares of the city, where all the principal hotels are situated.

At the present time, the station is equipped for the testing for power purposes of peat only. The power plant consists of a double zone peat gas producer, wet coke scrubber, tar filter and dry scrubber, a 4 cycle single acting Korting gas engine of 60 effective horse power, a 50 K. W. direct connected Westinghouse direct generator, and a resistance stand for absorbing energy generated.

Many plants of this description are in commercial operation in Sweden and Germany, where the economy and reliability of gas power plants utilizing peat has been amply demonstrated.

The power generated at this station will later be utilized in running the machinery of a metallurgical laboratory.

The peat for the operation of the producer will be supplied from the peat bog owned by the Mines Branch, Department of Mines. This bog is situated at Alfred, on the C. P. R., near Caledonia Springs, tbout 40 miles distant from Ottawa, and has an area of about 300 acres. The Anrep process for manufacturing air-dried peat is employed, the plant installed having a daily capacity of about 30 tons of air-dried peat.

Discussion and Questions.—There will always be space given in the pages of The Journal of the American Peat Society for letters of inquiry, or discussion either of the subject matter contained in previous issues or that in other similar publications. It is desired also that those having suggestions or new matter that they wish to present informally communicate these in the form of letters. Questions of a practical nature and the discussion of new and interesting methods of utilizing peat are especially desired, and ample space will be given such matter, and to answering communications.

The Outlook.—The present number of this Journal is the first of a new volume and commemorates its third anniversary. Each quarter, for two years, it has made its appearance with reasonable regularity, considering the fact that preparation for

these occasions has always to be made subordinate to other duties by all concerned. At the outset of the new year of its career, it may be well to see just what progress has been made since the first number was printed in 1908.

The Journal itself has increased from a scant 22 pages of reading matter, to about 40 pages for each issue, and has probably increased in general and special interest in even larger percentage. It is certain that the subject matter of the present number is of much more value than that of the first number printed, for it deals with the subjects discussed at first hand.

The outlook for the development of various lines of peat industry has never been so good in America as at present. This is especially true of peat fuel enterprises, some of which are noted in other places. Most of these are in the hands of men who have already had experience in the work they are undertaking, and will be carried on in simple and inexpensive plants, with rather small estimated production, and may well be considered demonstration, rather than commercial plants; several of them are given this name, in order that too much may not be expected of them. These are distinct advances, due, to some extent at least, to the educational work of this Society and Journal.

If present advices are to be relied upon, the coming season will see the launching of new peat utilizing enterprises in Minnesota, Iowa, Illinois, Michigan, Indiana, Ohio, Maine, Massachusetts, (several) and Florida. New plants also seem likely to be established in New York, New Jersey, Connecticut and Oregon.

In 1909, experimental, demonstration and commercial factories for manufacturing peat into fertilizer filler or fuel were operated more or less extensively, in Maine, Massachusetts, Connecticut (1 reported), New York, New Jersey, Pennsylvania, Florida, Ohio, Indiana, Illinois, Michigan, Iowa and California. To those operated in the United States must be added at least one in Mexico and those which were at work in Canada, including that under control of the Department of Mines. Most of these will, without doubt, be carried on during the coming season, and, with favorable weather conditions, and the experience gained during past operations, the year 1910 will do more for the peat industry in America than any preceding one.

The business outlook is encouraging. In the meantime the members of this Society may well consider whether they are doing their share in stirring up and maintaining the interest in the work which, as an organization, they have started to do. The Society needs, and must have, more members, and its membership must be increased largely by the individual effort of those who already have assumed the duties and privileges of membership. Let every person who is interested in the work of

the American Peat Society push for more members and a larger field of influence.

The National Peat Utilization Company has established a plant for making peat fuel by a new process on the Neponset Meadows in Norwood, a few miles out from Boston. The company will also make peat litter and mull. The Dedham, Mass., Transcript is authority for the statement that the plant was to be in readiness for operation about March 1. That is a good time to begin peat work, if the season is favorable.

The Peat Coal and Gas Company, an incorporated company with $10,000 capital, was recently formed at Toledo, Ohio, by A. J. Grubach, H. J. Jarvis, Jacob Weidmer and others. The company will manufacture machinery for making peat fuel, reported by the Toledo Blade, to be a process for coking peat and recovering by-products, and the invention of Ellis Bartholemew. The capitalization reported is surely very modest for launching a process for making peat coke or charcoal.

The Value of Peat.—Under this head, the New York Sun of March 17, reprints the following statement from the London (Eng.) Globe: "An object lesson in the utilization of peat bogs has for the last few years been carried on in northwestern Germany. Some 16,000 acres of moorland, known as the Friedeburg bogs, are being reclaimed and the peat used for the supply of electric power. The land is cultivated by settlers, who, at the same time, cut peat and sell it to the electrical supply company with works on an island in the middle of the bog. It is expected that this central power station will supply electricity for light and power for a region of 30 miles radius. Already it supplies electric light to Emden, Wilhelmhaven and several other large towns and cities.

As by-products of the conversion of the energy of the peat into electricity, large quantities of ammonia and hydrogen sulphide are made and sold. As part of the work, 38 miles of new canals are to be made, and, in order to accomplish this, about 650 acres of bog have to be stripped of their peat. Thus, in making the canals, 250,000,000 cubic feet of peat would be supplied for the central power station; and this, it is reckoned would keep it going, at its present rate of production of energy, for 66 years."

This account refers to the same development described somewhat at length by Dr. Heber in the last number of the Journal. It is reprinted here because the account supplies some details not given before and because of the bearing which this great work has on American conditions. Several great drainage plans are being carried out, or are being considered, in states remote from coal fields. In some of these wood will be used for fuel for the dredging machines, but in others the work can be

done by the peat that must be dug out for the main canals and their branches, if some attention is given to the matter. Unfortunately, it is too often the case that the peat dug from such drainage canals is thrown out on the banks and either goes to waste, or slowly settles back into the excavations, thus making the whole work useless. Our friends in Germany have certainly attained methods of utilizing and conserving their resources, not even thought of by most of the people of this part of the world.

Peat Fuel Manufacture in Minnesota is a possibility in the near future. Mr. P. W. Belangee, of Waterloo, Iowa, in company with others, is reported about to start a large peat fuel enterprise at Fertile, Minn., where an extensive bed of peat has been secured. The peat is reported to be from 30 to 40 feet above the surrounding land, and to be the only upland peat bed in the country; it is also of excellent quality.

The general interest in peat is shown by he grade of the papers that publish matter relating to it. A case in point is the item relating to the German power plant, which was given space in two great metropolitan dailies. Another example is that of a leading Pittsburg, Pa., daily, which, not long since, gave space to a short illustrated article entitled "Utilizing Peat as a Fuel." One would naturally think that the people of the center of coal production would not care for items relating to peat, but the editor of the paper evidently thought otherwise. Still another prominent paper in the coal country of Pennsylvania recently gave nearly a column of space to a news letter on Peat and its uses.

The European Process Peat Company, Ltd., with a capital of $75,000 has been formed in Canada. Mr. Ernest V. Moore, of Peterborough, Ont., is the engineer and manager of the company and expects to use a portable machine designed by himself. It will be remembered that Mr. Moore is the author of the paper "The Peat Industry and its Possibilities" for which the Gowski Medal was awarded him by the Canadian Society Engineers in 1909. He has also had unusual experience in manufacturing peat fuel, and was a charter member of this society.

The National Peat Fuel Company of Detroit, Michigan, for several years inactive, is winding up its affairs. The briquetting plant at Chelsea, Mich., which made short demonstration runs one or two seasons some years ago, was advertised to be sold on Saturday, April 23, by S. E. Whitney, trustee for the bondholders. It is presumed that the sale was due to court proceedings. The building is well made and exceptionally well located on the edge of a good peat bed, close by a good-sized village, and with a trunk-line electric railroad connecting it with several large

towns; the Michigan Central R. R. main line, also has a station at Chelsea.

Canadian Peat Experimental Plant.—The Montreal Star is authority for the statement that the work of installing the machinery for the peat plant of the Dominion Government for experimental purposes, was in progress in January, under the supervision of Mr. Menking, a German expert. This item seems to refer to the gas-producer for using peat fuel that was imported from Germany, last fall. Later news, states that the gas-producer has been installed and successfully tested. It will be run during the summer and will be in complete running order by the time of the annual meeting of The American Peat Society to be held at Ottawa in July, 1910.

Peat Developments in Indiana.—Aside from the plant to be built at Lakeville by the Peat Products Co., citizens of Fort Wayne and Elkhart, Ind., have become interested in the possibilities of peat as fuel by exhibitions of its burning qualities in these cities. No reports of plants being built near these towns have been received, but the people who saw the exhibitions were warmed up to the fact that there was excellent fuel lying unused in the marshes in the vicinity of their cities.

Th Commercial Artificial Co., of Toledo, Ohio, has been assured that the electric railroad running near their property will be fully equipped and put in operation this summer. If this is done, the company will at once begin to make peat fuel at its Factory No. 1, near Lambertville, Mich. In view of this possibility, the scow excavator, formerly used, has been sold, and one of the Peat Engineering Company's portable plants will be used instead. A coal dealer in Toledo has made a tentative contract to handle the output of the plant.

Dr. Martin Ekenberg, of London, Eng., the well known inventor of the wet carbonizing process, which bears his name, died suddenly in February. Dr. Ekenberg had been at work for some 8 or 10 years, or more, on the problem of making peat into a compact and high class fuel, and, at one time, received a grant of money from the government of Sweden to aid him in getting his plan worked out to a commercial basis, and such favorable reports were made on this experimental plant that an English company was formed to build a large commercial plant. At last accounts, this was about completed, and it is hoped that the death of the inventor will not prevent the successful development on a commercial scale of what is the most promising continuous process for making peat into briquets that has yet been described; if successful, it will be a lasting monument to the skill and persistence of the inventor.

The American Refining and Reduction Company, of Toledo,

Ohio, is reported to be testing newly invented machinery for making peat briquets independent of weather conditions.

Fires set in Swamps by sparks from passing locomotives are likely in the near future to prove very costly to the railroads, especially now that the peat in such swamps is likely to come into the market both as fuel and for fertilizer purposes. Already two railroads in Indiana, the Wabash and the C. C. C. and St. L. have been sued for damages to peat lands by fires said to have been started by their engines

The damages from fires are of two sorts, the destruction of saleable material and the rendering useless of such material by so irregularly burning the surface as to make it impossible to profitably take out the portions of the peat not burned.

The Plant of the Michigan Peat Co., at Eaton Rapids, Mich., may again produce fertilizer filler this season. Mr. E. D. Harkness, Trustee, who bought the plant, for the bondholders when it was sold at chancery sale in January, was recently in Toledo making arrangements for the summer, and reported that many advance orders had already been taken at a higher price than was received last summer. The plant was leased last season to the Ann Arbor Chemical Company.

Swamp Drainage in Minnesota.—State Drainage Commissioner George A. Ralph, Engineer, St. Paul, Minn., has asked for bids for the digging of ditches Nos. 83, 90 and 92. These will be among the largest ditches ever dug by the state. Their length will aggregate more than 200 miles; 200,000 acres will be drained by them, and it will be necessary to move more than 3,500,000 cubic yards of dirt in their construction.

The Peat Products Company, of Lima, Ohio, have obtained leases on 1500 acres of peat land and swamp land near Lakeville, Indiana, and have begun construction work on a peat briquet plant on the line of the Vandalia Railroad. The company will use the machinery and processes described by Mr. J. H. VanGlahn in his paper read at the Boston meeting. This paper will be published in full in the next number of the Journal and with it a more extended account of the operations at the Lakeville plant. Lakeville is about 10 miles from South Bend, Ind., which is the nearest large town.

The National Peat Fuel and Gas Company, of Chicago, organized to develop the manufacture of peat fuel by the machinery and process devised by Philip Heseltine, will continue work during the summer at the plant at Bancroft, Mich., run by Mr. Heseltine last season. The mechanical equipment will be completed along lines suggested by the experience gained last year. Another fully equipped unit plant will be operated for demonstration purposes near Chicago. Mr. L. J. Weadcock of Toledo, a representative of this company, called recently on the

Managing Editor of this Journal and reported that a number of plants were being installed in different parts of the Middle West.

There is also an unconfirmed newspaper report that one of these plants has been located near Forest City, Iowa, in the center of the peat area of that state.

Cutting Peat by Wind Power.—Daily Consular Reports, in a recent issue describes from near Dunfermline, Scotland, the use of a windmill to furnish power for cutting peat. In certain locations, in the north of this district, a considerable industry has recently grown out of the manufacture of moss litter. The yield, which may be said to be abundant, if not inexhaustible, is cut and gathered in trucks, rolling over portable rails, extending from different parts of the field to a common terminus, the drying racks. Here, to hasten evaporation the peat is further broken up by machinery, the generating power for which in the instance under review, is supplied by a windmill, 14 feet in diameter, erected to a height of about 35 feet. There is also an auxiliary pump attachment for forced drainage of the bog, subject to adjustment and regulation.

This mill which has been in successful operation for some time, is said to accomplish in less than one hour, an amount of work it formerly required 4 men a day of 10 hours to equal, and, owing to the exposed position of its location and the almost continuous winds prevailing in this country, it is rarely, if ever, out of commission.

There are many parts of the United States, especially in the Great Lakes region and west, where windmills could be used effectively for pumping water to drain working trenches and other parts of bogs, where natural drainage, by ditching, is difficult or impossible. Work like that mentioned above could also be done by wind power in many cases.

The Peat Engineering Company of Toledo, has applied for a charter from the state of Ohio. Well-known business men of Toledo have associated themselves with the founders of the company, forming a close corporatin, with a capital of $50,000 and with headquarters at Toledo. The object of this change is to provide more capital to care for the increasing business of the company. Several contracts for the portable plants developed by them have been secured by the company, and the season of 1910 promises to be a busy one. The officers of the new organization have not yet been announced.

Dr. Ludwig Mond, the distinguished chemist, inventor and technologist, died on Dec. 10th, 1909, at his home in London, Eng. Among other important inventions of this noted man was the by-products recovery gas-producer for bituminous coal, which bears his name. The principle on which this type of pro-

ducer is based, was worked out by Dr. Mond in the laboratory, and afterwards made commercial. The chief by-product obtained is ammonium sulphate, and Mond's especial contribution to the subject of ammonia recovery from the combined nitrogen of the fuel, was that of keeping the combustion of the fuel-bed in the gas-producer at the lowest practicable temperature at which producer-gas could be formed, by the use of excess of steam with the blast. This process is of especial interest to advocates of peat utilization, because the much-talked of Caro-Frank method for gasifying peat and recovering ammonia, as a by-product, is very similar and is apparently a modification of Mond's.

Newfoundland Peat as Fuel.—The bonus of 25 cents per ton, which was offered by the government of Newfoundland last year, for a period of 5 years, has now been offered for a 10 year period. The Peat Engineering Company, after examining some of the peat deposits of the country and making careful tests of the peat, has entered into contracts with a strong company, formed to operate under the government bounty, to furnish the necessary machinery.

The Peat Industry Company, of Mexico, will continue the development of their plant a few miles from the city of Mexico.

Peat Exhibition in Minnesota.—One of the most successful and attractive exhibits at the Conservation and Agricultural Development Congress held in St. Paul, March 16-19, 1910, was a collection of peat and its products projected by Mr. Max Toltz of St. Paul, but aided and abetted by those indefatigible peat enthusiasts, the Secretary of the American Peat Society and the Vice President for the Great Lakes Region, Mr. Carl Kleinstueck. The society collection, which received a medal at the Jamestown Exposition, added to by contributions from the private collections of these gentlemen and from other members, was taken to St. Paul and installed by Mr. Kleinstueck, who acted as curator during the meetings and interested many visitors in the work of the society, and in peat utilization generally. The meetings were interesting and the attendance beyond the best anticipations of the commission (of which the governor of the state was chairman) having the congress in charge.

A paper on Minnesota peat deposits and their possible value to the state, was read at one of the meetings by Mr. Toltz, who has made an earnest investigation of the subject both in this country and in Europe. This paper is published in the present number of the Journal.

During the Congress, a number of those in attendance became so much interested in the work of the American Peat Society that they have become members and it is expected within a very short time that enough members will be found to form a Minnesota Section; this will give them the distinction of being

the second state section to organize.

The following letter is printed here to show that the work of our secretary is appreciated and also as a matter of record:

Statt of Minnesota, Executive Department,
Adolph O. Eberhart, Governor.

St. Paul, March 30, 1910.

The Secretary,
American Peat Society,
Kingsbridge, New York.

Dear Sir:—I desire at this time to make personal acknowledgement of your courtesy in providing the peat exhibit for the recent Conservation Congress held in St. Paul. On behalf of the Conservation Commission, I wish to assure you that your courtesy and enterprice are fully appreciated and your exhibit, with that made by Mr. Toltz, was one of the most gratifying features of that occasion.

Very truly yours,
(Signed) A. O. Eberhart,
Governor.

CORRESPONDENCE.

Elmwood, Conn., Mar. 15, 1910.

The Editor, Journal of the American Peat Society.

Dear Mr. Editor:—Having discovered a very simple and inexpensive way in which any one can test peat for himself to determine the amount of volatile matter, fixed carbon and ash which it carries, and believing it will be of some interest to your readers, I am sending you an account of the method and sketches to make it plain.

A simple pepper-box, spice-box, or any metal box with a tightly fitting lid will do for the purpose. The lid is punched with five holes to allow the gas to escape. A box of this sort will hold at least one-fourth pound of dry peat. The peat can be had by any one by taking it from the bog and grinding it through a meat cutter, or by pounding it to a pulp in a mortar, after which it must be dried in a stove, under a low heat, so as not to lose much of the volatile matter. When perfectly dry, the peat is carefully weighed and put into the box, the perforated lid put on, and the box is set into the fire of a kitchen stove, the lid of which is left up.

Gases will at once begin to pass out of holes in the box-lid, and, in a short time, they can be lighted and will burn with a beautiful color and strong flame for 30 to 40 minutes. When the flame goes out, the box is taken out of the stove and turned upside down in a saucer filled with sand to keep the air from entering the box. As soon as cold, the residue is shaken from the box and weighed again. The difference between the two

weights is the weight of volatile matter, that of the residue, the weight of the coke. The charred peat is then placed in an open dish and burned until nothing but ash is left; of course care must be taken not to lose any of the ash, and to burn out all the carbon. When the ash no longer has any trace of black, it is cooled and weighed; the difference between the weight of the ash and that of the coke is the fixed carbon; in this way, the amount of volatile matetr, fixed carbon, and ash can be found by the use of a simple pepper box. (Fig 1.)

(The results can be converted into percentages by dividing each weight obtained by the original weight of the dry peat and multiplying the result by 100. Editor.)

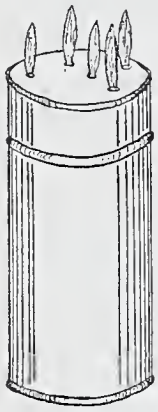


Fig. 2. Pepper Box. A simple way To test peat for gas.

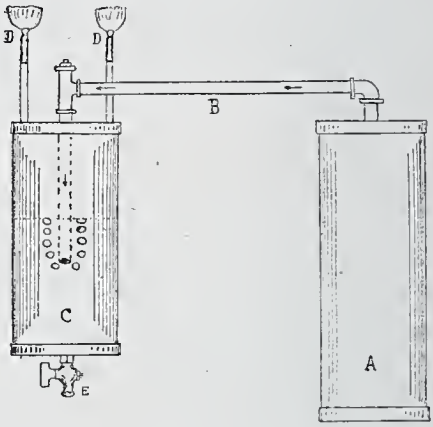


Fig. 3. Retort for making peat gas. A Retort. B. Connecting Tube C. Condenser. D. Burners. E. Pet-cock.

I have also improved on this simple device by having the retort made of a short piece of 2½ inch iron pipe, capped on both ends with ordinary pipe caps; the top cap is drilled for a one-half inch pipe.

In connection with this retort, we have the second retort or condenser, made up in the same way, with pipe and caps. The top cap of the condenser is drilled for a one-half inch pipe in the center, and, near the edge on either side of this half-inch hole, openings are made for one-eighth inch pipes, which are furnished with gas burners. The bottom cap is also drilled with a threaded hole in the center and a pet-cock screwed in, and the condenser is then connected with the retort by a half-inch pipe of such length, that when the retort is placed in the fire in a kitchen stove, the condenser will be some inches away from the side of the stove. (Fig. 2.) The end of the half-inch connecting pipe which enters the condenser is made with a running thread, so that it will pass down into the condenser to

within a few inches of the bottom. When in use, the condenser is filled with water to above the end of the inlet pipe, so that the gas in passing from the retort is delivered in the condnser under water. This liquefies the condensible gases, while the permanent ones pass up through the water to the burners, where they may be burned. The difference of the weight of the water placed in the condenser and that drawn off through the pet-cock in the bottom, after the gas has stopped coming off, is the weight of condensible gases.

It is thus evident that by this simple method it is possible to get both the by-product and the combustible gases, as well as the fixed carbon and ash. This little apparatus works well and with it one is enabled also to get the candle power of peat gas, which burns with a rich yellow color and very brightly. The flame would go, I believe, at least 15 candle power without enriching the gas with any hydrocarbons. This generator enables one to study peat gas and to carbonize peat in a very satisfactory way.

I am sure the pepper-box will be of interest to all owners of bogs.

Yours very truly,
W. L. Shepard.

Editorial Note.—In using the second method, the half-inch connecting pipe should always be carefully examined to see that it is free from obstruction before the retort is put in the fire, otherwise the gas pressure might burst the generator.

In a leter of recent date to the Secretary of this Society, M. Henri De La Conte, Cormicy, near Rheims, France, requests that price-lists descriptive of American peat machinery be sent him at the address given above.

QUESTIONS.

The following questions have been received, and it is hoped will be answered, so that the answers can be published in July.

If a cubic foot of wet macerated peat weighs 66 pounds, and dries down to 6 pounds, at which weight it is assumed to contain 10 per cent of water, what was the original percentage of water?

A rotary drier has an hourly capacity for drying to complete dryness 40 tons of cement rock, assumed to average 10 per cent of moisture. What will be the hourly product of peat filler containing 10 per cent moisture, if the peat when fed to the drier contains 50 per cent water? What would be the average hourly charge, if peat that contains 70 per cent water is used, and the product is to run 10 per cent water when sold? (For convenience it is supposed that the water dries from the cement rock at the same rate as from peat.)

A REVIEW.

Commercial Peat; its uses and possibilities, F. T. Gissing, London, 1910. Charles Griffin and Co. Ltd., Exeter Street, Strand.

This excellent manual on the utilization of peat is, as its name indicates, a discussion of the commercial uses of peat and, to a consderable extent, its future possibilities. It supplements and brings down to the date of its publication the earlier work by the same author, associated with P. R. Bjorling, entitled "Peat; its use and manufacture," noticed in this Journal, Vol. II, No. 2. (July, 1909.)

The contents consist of 29 chapters, 7 appendices, a bibliography, of recent European publications relating to the uses of peat, and a list of the more important patents granted, and applications for patents made, in England and other countries, on peat machinery, and processes of treating peat, since the year 1900. This list gives the year and number of the application, name and address of patentee or applicant, and the subject of patent or claim.

In the body of the work, some of the important chapters are: Alcohol from Peat; Ammonia from Peat—Woltereck Process; Nitrates from Peat; Ekenberg Wet Carbonizing Process; Peat-gas, Peat-gas Producers; Ziegler's Peat Coking Process at Beuerberg, Germany and at Dartmoor, England—Paper from Peat. Dryers, excavators, cutters, disintegrating machines, squeezers, drying ovens, hydro-extractor, and pallet-conveyors are each given chapters and some modern types of construction are described and figured. "Manufactured peat fuel" is the title of a chapter in which some well-known, and several new and untried, processes are briefly discussed, the author referring to his former work for a more elaborate discussion of this subject. Several short chapters are given over to descriptions of peat moss litter and mull manufacturing, late patterns of presses, etc., being described and figured.

The "Lenox" Peat Plant is described in detail in Chapter XXVII, with illustrations of the more essential details of the machinery, including a patented drier and a briquetting press for forming wet briquettes, in the form of 4-inch cubes, at the rate of 16,000 to 18,000 per hour.

The "Lenox" patent interlocking, portable tramways and gantries for handling the peat blocks during air-drying out of doors, are also described and illustrated. The last chapter is given to the description of some of the more notable peat-bearing districts of the world, with brief accounts of the ways in which the peat in them is utilized.

The appendices are: I. The Astor Vibratory Peat-Gas-Producer; II. The Distillation of Peat; III. Peat Coke; IV. Peat Half-

stuff, Paper and Boards; V. Use of Peat in Scotch Distilleries; VI. The Lennox Patent Horizontal Revolving Peat Drier; VII. Mond Peat Gas Plant.

The Bibliography gives a list of many important recent peat papers published in various parts of the world, supplementing the list given in the author's earlier work. A feature of the book is the number and excellence of the illustrations, 58 in all, a good proportion of which are full page, either half-tone reproductions of photographs, or line etchings of plans and drawings.

The style of the writer is pleasing and readable, clear and concise, and yet sufficiently full of detail in the more important parts. It is to be regretted that the reader is not always made certain that the particular process described has been actually tested in a practical way, and, in some cases, is left with the impression that methods of preparing peat for fuel now known to be impracticable, have proven successful in commercial operations. The book, as a whole, however, is an excellent one. and is a welcome addition to the literature of the subject, and no one who is interested in knowing the most recent developments in the commerical uses of peat abroad, should be without it. It is a very useful manual.

PUBLICATIONS.

Peat and Peat Deposits of Iowa. S. W. Beyer. Iowa Geol. Surv., Vol. XIX. Ann. Rept. 1908, pp. 689-734. Des Moines, 1909. Apply to the State Geologist. Contains many analyses of Iowa peat.

Organic Nitrogenous Compounds in Peat Soils. S. L. Jodidi. Mich. Agric. Exp. Sta. Technical Bulletin, No. 4. East Lansing, Mich., 1909. Also in Jour. Am. Chem. Soc., Vol. XXXI, No. 3, Mar., 1909.

Flora Northern Iowa Peat Bogs. L. H. Pammel. Iowa Geol. Surv. Vol. XIX. Ann. Rept. 1908, pp. 739-784, Des Moines, 1909. Also printed as No. 40 Contributions Bot. Dept. Iowa State Coll. of Agric. and Mech. Arts.

Preliminary Report of Peat Deposits in North Carolina. Charles A. Davis. N. C. Geol, and Econ. Sur. Economic Paper No. 15, pp. 147-162, Raleigh, 1908. Apply to Joseph Hyde Pratt, State Geologist, Chapel Hill, N. C.

Some Commercial Aspects of Peat as a source of Chemical Products. Charles A. Davis. Economic Geology, Vol. V, No. 1, Jan., 1910.

The Electrical World of March 17th contained a short article explaining the purposes of and the field covered by this Society.

Cassier's Magazine for March is a splendid production. The

number is given over to locomotives in this and foreign countries, and is beautifully and thoroughly illustrated.

The Electrical and Mining Journal of March 12th states that Chicago capitalists have taken steps to establish a plant for the manufacture of peat fuel at a point near Fort Wayne, Ind. It is reported that the men interested have taken an option on 6,000 acres of peat land.

Power and The Engineer for March 8th contains an interesting short article on "The Value of Irish Peat Bogs" taken from the Irish Year Book of 1909. Among other things, it says, there are in Ireland 2,800,000 acres of unutilized bog land, with a varying depth of over 16 to 30 feet; accordingly the total calorific value of these bog lands of Ireland is estimated as being approximately equal to that of 5,104,000 tons of coal.

ANNUAL MEETING.

The annual meeting of the American Peat Society for 1910 will be held at Ottawa, Canada, on Monday, Tuedsay and Wednesday, July 25, 26 and 27

The Canada Department of Mines, Mines Branch, has a peat fuel plant in operation near Ottawa, in which the best European methods and machinery are in use, under the direction of Mr. A. Anrep, Jr. In Ottawa, the Koerting Gas-Producer for peat fuel, also installed by the Department of Mines, will be in operation, and ample opportunity will be given every member of the Society to examine both of these plants.

A programme, embodying the results of progress in peat utilization, during the year, will also be presented, and it is hoped that all members of the Society, and others not members who are interested in getting exact information, and in seeing for themselves the posibilities of peat fuel, will attend this meeting.

For full information, programmes, etc., apply to the Secretary, Julius Bordollo, Kingsbridge, New York, N. Y.

Annual Meeting. The season's run for 1910 of the peat fuel plant, operated by the Canada Department of Mines, will end on July 31.

As it is very desirable that this model plant should be seen in full operation by the members of the American Peat Society, it has been decided by the Executive Committee to hold the annual meeting on Monday, Tuesday and Wednesday, July 25, 26 and 27, at Ottawa. Full particulars in the July number of this Journal.

Members desiring to present papers at this meeting are requested to send titles to the Secretary a soon as possible, so that the programme may be made up at an early date.

Journal of the
American Peat Society

VOL. III JULY, 1910 No. 2

THE UTILIZATION OF PEAT AS A SOURCE OF NITROGEN FOR PLANT FOOD.

By Prof. H. D. Haskins, Mass. Agricultural Experiment Station, Amherst, Mass.

(Read at the Boston Meeting.)

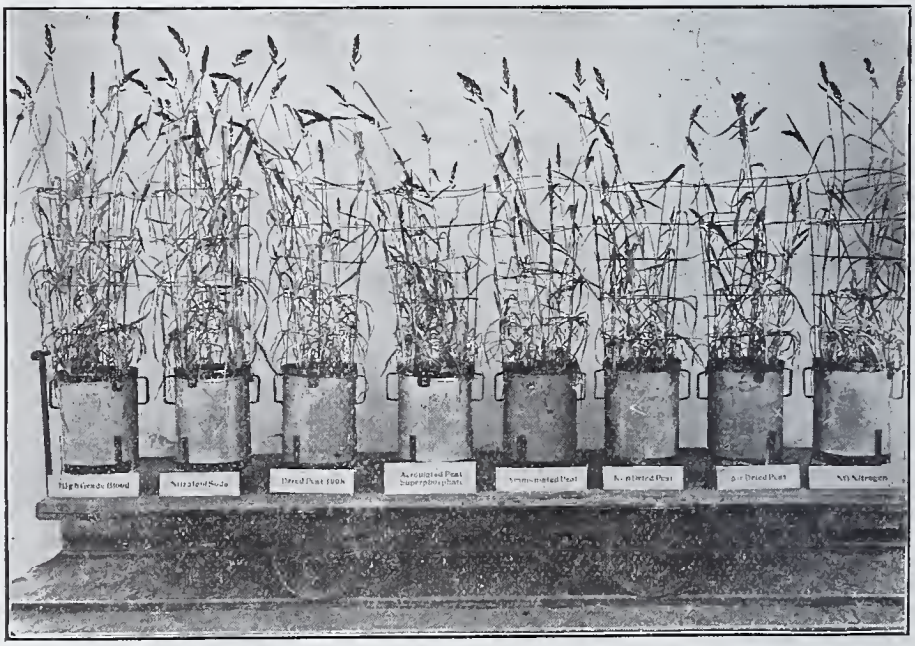
A chemical analysis of peat reveals the fact that the only constituent which it contains in sufficient quantity to prove worthy of consideration as an ingredient of plant food, is its nitrogen. The analysis of peat ashes shows only a small fraction of a per cent. of potash, phosphoric acid and lime, too small in fact for consideration on account of the relatively low cost of these three elements of plant food in their best forms, in our general markets.

The most costly element of plant food is nitrogen in its various forms, varying from 18 to 22 cents per pound, according to the ease with which it becomes available to the growing plant. The better forms of potash and phosphoric acid can be purchased for from 4¼ to 5 cents per pound. It will be readily seen, therefore, that any substance which contains an appreciable amount of nitrogen, which may be utilized as plant food, deserves our earnest consideration. The better grades of peat often show as high as 2.5 to 3.+% of this valuable ingredient, and being found in such immense quantities and so widely dispersed throughout the country, it behooves us to give it a careful study from an economical standpoint.

To begin with, we all realize that it is not the nitrogen alone that gives peat or any other organic manurial substance its superior value as a fertilizer. We depend upon these substances to furnish valuable organic matter and humus without which it is impossible to successfully grow a crop, even with the most concentrated mineral fertilizers. We depend upon these substances further to improve the mechanical condition of soils, to make the compact clay soils more open and porous, to make the light sandy soils more retentive of moisture and to

furnish conditions whereby the soluble plant foods may be retained near the surface of the ground within reach of the rootlets of growing vegetation. We all acknowledge the value of barnyard manure as a fertilizer, and yet when we glance at its chemical analysis we may be astonished at the small amount of nitrogen, potash and phosphoric acid which it carries. The average of 38 analyses of barnyard manure made at the Massachusetts experiment station shows only .42% nitrogen, .53% potash and .31% phosphoric acid. If we should calculate the commercial value of this manure by the trade values of fertilizing ingredients adopted by the New England experiment stations for the year 1909, we would find that the plant food in a ton of the manure was only worth $2.25. But the agriculturalist recognizes the value of the organic matter furnishing humus and is willing and expects to allow a reasonable amount for the same. It is well known that peat carries a relatively high percentage of humus, and this fact in no small degree enhances the value of this material as a fertilizer. But setting this important fact aside, let us consider the value of peat when based upon its content of nitrogen and the availability of this most expensive element of plant food.

But little work has been done by the scientific acriculturalist to establish the relative value of peat as a fertilizer. A few analyses have been made in various experiment stations by the alkaline and neutral permanganate methods, which show the



Pot Cultures of Millet, 1909. (Plate 1.)

better grades of peat to have a nitrogen availability of 21.4% as compared with blood and fish having a nitrogen availability of 65% or over, but this is only comparative; these figures do not actually show the true amount of nitrogen which is available; this can only be accomplished by vegetation experiments.

The agricultural department of the Massachusetts experiment station has for two years been carrying on such experiments by growing millet in pots under conditions which can be absolutely controlled in every detail. (Plate I.) The experiments in question were not instituted for the sole purpose of studying the availability of nitrogen in peat, but rather to make a detailed investigation regarding the availabilty of nitrogen from every well-known source whether of a mineral or organic nature. The duplicate investigations were conducted in galvanized iron pots holding 38.75 pounds of soil. Each pot was fertilized with an abundance of potash and phosphoric acid, and the same amount of nitrogen was applied in each instance (5.4 grams) a few days before planting the millet seed. Five millet plants were allowed to grow and reach maturity in each pot. Their care was the same every day as regards cultivation and watering, the same weight of water being applied to each pot. The trucks holding the pots were run under a glass house every night and day when stormy.

In the tabulated results for the year 1908, which I have procured for this occasion, only a few of the results of the experiment appear, but they are in sufficient detail to show the general standing of the peat.

Nitrogen Experiments with Millet, 1908.

	Grams Dry Matter.		Percentage Increase	
Fertilizer.	Seed.	Straw.	Seed.	Straw.
Nitrate of Soda.....	66.17	86.25	87.55	78.09
Sulphate of Ammonia..	61.45	92.52	74.17	91.03
Calcium Cyanamid	57.97	86.59	64.31	78.79
Blood	58.19	82.89	64.93	71.15
Cotton-seed Meal	55.23	81.23	56.54	67.72
Peat	37.20	53.53	5.44	10.53
Nothing	35.28	48.43	.....	.....

Sulphate of ammonia leads with a percentage increase over the nothing pots of 74.17% of seed and 91.03% of straw. The peat shows up rather low, having a percentage increase of only 5.44% seed and 10.53% straw. These results are, of course, not conclusive, as they show only one year's investigation.

During the present year we have included other samples of peat in the pot experiments—a so-called ammoniated peat, an air-dried peat, a kiln-dried peat and an acidulated peat. The first three were forwarded by Mr. Robert Ranson, of St. Augus-

tine, Florida. The ammoniated peat was said to have received an addition of a solution of ammonium sulphate made by the dry distillation of peat. The acidulated peat was prepared by the writer according to the usual process employed by the fertilizer manufacturer in the making of a so-called base goods. The process in short is as follows: A natural tri-calcium or rock phosphate was treated with sulfuric acid in the usual manner as in the manufacture of an acid phosphate. During this process the mixture becomes hot, due to the chemical union of the sulfuric acid with the lime in the phosphate, and at this point is of the consistency of thin mud. As much dry ground peat as possible was then stirred into the mass until it became too stiff to be further manipulated. It was allowed to stand several weeks before being ground and anaylzed. The dry ground mass tested .39% of nitrogen.

It might be mentioned at this point that the conditions under which this material was made were not identical with the process as carried out on a large scale in a fertilizer factory where hundreds of tons of the base goods are made at one time and where the material remains at a high temperature in the pile for weeks. Where only a few pounds are made in the laboratory the material cools within a few hours and the chemical action is reduced or ceases altogether.

As for the results obtained in the pot experiments with millet this year, the season is not far enough advanced to give weights and percentages of increase, but I have had a photograph taken which shows the growth and general appearance of the millet plants. You will notice that the acidulated peat shows up very well indeed, the plants seeming to reach maturity sooner than in other cases. This fact being probably due to the large amount of phosphoric acid furnished by the mixture; an excess of this element of plant food being known to favor early maturity.

Now as to whether this process of acidulating peat is practical and economical. It is of the opinion of the writer that the time is coming when the nitrogen in peat will probably be utilized by a method similar to the one described above. It is questionable, however, if it can be made a paying proposition at present on account of the large variety of other more concentrated and easily accessible ammoniates, both animal and vegetable, that can be used in this process. It is claimed that garbage tankage of our large cities can be economically made into a base goods resulting in a high degree of availability of its nitrogen. The writer has successfully made a base goods from wool waste, the resulting product of which showed nearly 100 per cent. of nitrogen availability.

It is, of course, desirable to utilize peat as a fertilizer on as large a commercial scale as is possible, and we will all wel-

come the introduction of some process whereby this material may be made available for extensive use. In the meantime, however, there is no reason why peat should not be utilized to improve the chemical and physical condition of soils. It is a well-known fact that dry peat is a most wonderful absorbent; experience teaches us, however, that it is rather slowly decomposed. If we can compost peat, therefore, with something that is teeming with bacterial life and which is easily decomposed, there is a gain in two ways. For instance, if air-dried peat is composted with manure from the horse stable, the bacteria in the manure aids in disintegrating the peat while the peat retards the too rapid decomposition of the manure, at the same time absorbing any plant food in the form of ammonia compounds or other soluble plant food elements that may be available. This is a very practical and economical manner of utilizing peat and it will be found that the resulting compost will prove a very successful fertilizer.

It may be necessary to make a frequent application of lime to soils on which such a mixture is constantly used and it may be found necessary in some cases to use lime in making the compost. The application of air-dried peat to light sandy or gravelly soils often results in their improvement quite materially. Such applications can best be made by a manure spreader and the peat may be applied to a depth of two inches. Freshly slaked lime should be used at the rate of five or six bushels to each cord of peat. The whole should be thoroughly harrowed into the soil and subsequently ploughed to a depth of four to five inches. As an absorbent and deodorizer in the stable, dry peat has few equals.

It might be added that many of our peat lands make our most productive soils when properly drained and reclaimed, especially is this true when the crops selected are particularly adapted to that class of soils. Natural peat soils are deficient in available mineral plant food which has become washed out through successive years of leaching. Such soils, therefore, need an abundant application of potash, phosphoric acid and lime before they will become productive.

The use of commercial fertilizers is increasing with enormous strides, and in a comparatively few years every source of plant food will be taxed to supply the demand for available ammoniates. As our western states become obliged to use more and more fertilizer each year, attention must sooner or later be turned towards our immense peat deposits.

The present seems to be a period of investigation and discovery. The manufacture of cyanamid compounds from the nitrogen in the atmosphere has furnished a most valuable economical source of nitrogen. This fact may retard somewhat the development of our peat industry from an agricultural stand-

point, although the fact that that furnishes valuable humus directly, while the mineral forms of plant food can only furnish it indirectly by growing a green crop to be subsequently ploughed under, will always be an incentive to its use in the natural or modified condition. The manufacturers of commercial fertilizers have recognized the value of peat as a dryer, an absorbent and a source of humus in which many chemical formulas are deficient; and some manufacturers are already using peat as a dryer and to improve the mechanical condition of fertilizer mixtures. How far this can be done legally and still comply with the fertilizer laws of our various states is an open question. If the manufacturer does not count the nitrogen which the peat carries in his guaranteed composition, but simply uses the material to improve the physical condition of his goods, there can surely be no serious objection to the practice. There can be no question but what the nitrogen in dried peat has a much lower availability than does the nitrogen in the high grade animal and vegetable ammoniates, and for this reason its use as a source of nitrogen in mixed fertilizers must be excluded in order to comply with many state laws.

PEAT MACHINERY AND PRODUCTION OF PEAT.

J. H. Van Glahn, Toledo, O.

(Read at the Boston Meeting.)

The continuation of the Twentieth Century, with its marvelous developments in the field of manufactures, presents no more interesting study than the development of the art and science of producing machined peat from the beds of the American peat bogs, where unlimited quantities of carbonaceous matter lie untouched, and from which may be obtained fuel, power, agricultural fertilizing substances and numerous by-products of high commercial value.

Before entering into the subject of machinery, and the production of machined peat, it will be well to remember that in peat production the real problem is how to get from a ton of wet peat the approximately 225 pounds of salable machined product in it, at a reasonable profit. It is evident that properly constructed machines, exclusively designed for peat production, and the omissions of unnecessary expenditures in the course of manufacture, will aid by so much, the solution of the peat problem in America.

The value of peat as fuel has been demonstrated and proven beyond any doubt, and it would be only waste of time to dwell upon this subject in detail, at present. Peat has been successfully used as a fuel for generations past, and is now being used

in almost unlimited quantities in many European countries, where it is abundant. Peat, compressed into briquettes, becomes very dense, is clean and convenient to handle, and, doubtless, will find a ready market for domestic purposes. The high price of anthracite coal should bring compressed peat briquettes in immediate competition with that class of fuel for domestic use, if produced and established in a desirable location, east, west or north of the anthracite regions, when transportation and freight rates are taken into account.

It will be necessary, in order to operate a peat plant successfully, to produce the fuel in sufficient quantity to supply a liberal demand, and to operate the plant at the minimum expense, or the venture will be of little or no consequence.

Method of Production.

The wet peat, or raw material, should be removed from the bog by means of a special vacuum excavating pump, and deposited into properly constructed drainage bins, connected with the peat plant; in these, the surplus water is drained off. A No. 7 vacuum excavating pump is the moost desirable for removing peat from the bog; this has a working capacity of 1,500 gallons per minute, at an elevation of 50 feet with 40 pounds of steam pressure at the pump; 50 per cent. of the volume handled a day by this pump is peat, equivalent to 3,750,000 pounds; 90 per cent. of this is water and moisture, which is to be extracted, which leaves 150 tons of dry, marketable peat per day, as the actual working capacity of the No. 7 pump. A small force pump should be used in connection with the No. 7 pump, to break down and dislodge the peat from the bank.

If the supply of water is limited, it can be returned from the drainage bins to the excavating pit of the bog and re-used, which assures the continuous supply of water, necessary to operate the pumps.

The pumps should be located on a flat-boat or scow built to float in shallow water. The excavating pump should be connected with the drainage bins by wooden pipes, coupled together with rubber joints to make the pipe flexible. By this method of pipe connection, the scow can be moved about readily, at the will of the operator, while the pump is in action, and can follow up the peat bank as the pump takes it up. One man and a boy can operate this excavating outfit successfully to its full capacity, and deposit the peat from the bog directly into the drainage bins.

The fuel for the boiler which operates the pumps, as well as the peat plant, should be producer gas, made from peat. Vacuum excavating pumps, to the knowledge of the writer, have been in successful operation for a number of years, pumping equally well, wood pulp, tan bark, sand, mud, phosphate rock,

grindstone grit, silica sand, and muck or marshy soil, and are known to have carried 60 per cent. of sand weighing 120 pounds to the cubic foot.

The peat, when sufficiently drained, is automatically taken from the bins and conveyed to the water extractor by means of a specially designed disintegrator, which breaks the cells of the fibers and allows the concealed water to escape, while the peat is in contact with the rolls of the water extractor. The water extractor consists of 24 cored, adjustable, polished iron rolls, each six feet long, and 13 cored hot plates, all supported in a heavy steel frame. The wet peat is brought through the heated rolls and over the hot plates by gravity. The rolls are arranged in sections, working independently of each other. The water is gradually removed from the peat by the action of the rolls upon the fibers as a minimum of pressure.

The machine weighs 20 tons and has 56,384 square inches of heating surface, constantly in contact, together with the pressure applied by the rolls upon the fibers of the product. The rolls, as well as the hot plates, are heated with waste steam; the working capacity of the machine is estimated at 171 tons of prepared peat, ready for the dryer.

The success of peat installation lies in the process of removing the water at the lowest possible cost. This, we are assured, can be accomplished with the Van Glahn water extractor. The peat falls from the water extractor, containing from 15 to 18 per cent. of moisture, into an agitator, which tears the material, formed into a sheet, into small particles and conveys it to the rotary dryer, where the final drying takes place.

In designing the rotary dryer, the inventor has closely followed the principle of heating the material only sufficiently to drive off the moisture; then, by applying a large quantity of dry, hot air, to absorb and carry away the moisture, as fast as it is driven off. This is proven to be the true principle for rapid and economical drying of any material.

The dryer consists of an outer and inner steel shell, 30 feet long by 5 feet 6 inches in diameter, supported in a heavy steel frame, constructed with a series of one and a quarter inch galvanized iron pipes arranged and attached to the inner side of the outer shell. The dryer is heated with exhaust steam from the engine driving the plant. The steam enters the inner shell through a swiveled point connection in the center, at the head of the dryer; the pipes attached to the outer shell are heated by steam transmitted from a connection to the inner shell.

The dryer is provided with an outer housing, made of concrete and brick. The space between the housing and the outer shell is a flue for the passage of the hot air taken from the stack of the boiler setting, by means of a fan, and transmitted into the outer shell. The heated air passes through the dryer,

between the inner and outer shells, mixes with the heat produced by the inner shell and pipes attached to the inner side of the outer shell. The steam is held in the inner shell and the pipes by means of a valve, allowing only the condensed steam to escape; the heat can be regulated to suit the conditions desired.

(To be Continued)

CONTINUOUS VACUUM FILTERS AS DEWATERERS.

By Robert Schorr, Engineer, San Francisco, Cal.

(Read at the Boston Meeting.)

One of the most serious problems encountered in many manufacturing undertakings is the elimination of large quantities of water, or of other liquids, at a reasonable cost. The importance of such operations has been frequently under-estimated, which has caused great disappointment and often a complete commercial failure. The financial investigation in that connection is an extremely simple one and, if all necessary data are known, the same will clearly indicate whether it will be advisable to expel the moisture by drying alone, whether it will be more economical to use mechanical means, or whether a combination of both modes will lead to the best results.

To obtain the highest commercial efficiency in any industrial art it is of first importance to have the process entirely automatic, or as nearly so as conditions will permit, without impairing the quality of the final product. For that reason, most of the intermittent-acting devices for removing moisture have found only a comparatively limited field, and in many cases they have been tried and discarded again. Foremost amongst these are the various types of filter chamber-presses, hydraulic and power presses, centrifugals and manifold arrangements combining pressure appliances with screens or absorbing surfaces. Most of materials treated in such machines still contain a large percentage of moisture, frequently a good deal more than originally calculated upon. The labor cost of their use is high and where waste furnace gases of cheap fuel are available, the continuous process in the drier will be preferable. Under some conditions, even the crudest disposition of air-drying will assure better economy than intermittent-acting apparatus.

The most important drying propositions are, naturally, those where the solid material forms but a small portion of the bulk handled. Such conditions are rather rare in nature, the peat bog being probably the most striking example. In many processes, however, a strong dilution has to be created to accomplish certain results, and,— if for no other reason,— to permit of cheap, long-distance transportation, either by pumping or by sluicing. Furthermore, there are a great many valuable

materials which could be recovered from the waste waters of factories, if such operations could be conducted to advantage.

A very important step in that direction is the development of the various vacuum and pressure filters. They all are, in their present practical execution, of quite recent date, and they were primarily designed for the filtering and washing of ore-slimes in cyanide plants. In such installations, the gold-silver-bearing solutions are withdrawn by means of a vacuum, or by pressure, through various filtering media, and the tailing is discharged, usually containing from 35% to 55% of moisture. While most of the filters in ore-reduction works are still of the intermittent types, (Moore, Butters, Cassel, Burt, Kelly, Blaisdell, Merrill, etc.) it is very probable that the continuous filters will replace the same on lower grade ores, where the washing is not quite as essential. In treating high-grade ores the intermittent working arrangements may hold the field, because the cakes can be washed most thoroughly for any length of time, while with the continuous filter, this period is limited and fixed. For mere dewatering, i. e., filtering purposes, there is nothing to excel the continuous vacuum filter, and it is surprising that this subject has apparently received but little attention in other industries.

Continuous vacuum filters can be grouped into the following distinct types, namely:

1. Machines with a horizontal, annular, stationary vacuum chamber upon which the filter bed is supported and confined between two concentric rings. A revolving arm carries a distributing box to feed the material to be filtered, evenly upon the filter bed, and slightly ahead of this feed box is a scraper or conveyor to remove the filtered material, discharging the same either towards the center, or over the outer, peripheral ring, for further disposition. The vacuum chamber may be subdivided, to permit of forcing compressed air through the filtering medium locally and prior to the discharging of the partially dewatered filtered material. Representative types of such machines are the "Hunt" and the "Parish."

2. Machines embodying the reversed principle of Number 1, i. e., employing a horizontal, annular filter bed, with a vacuum chamber below, which revolves, while the mechanism for feeding and discharging is stationary. Representative types: "Hunt," "Parish" and "Caldicot."

3. Machines consisting of a system of individual, pivoted filter trays, arranged circularly and revolving in a horizontal plane. Each tray has a vacuum chamber, which connects by means of pipes to a stationary valve, located in the center of the machine. After filtering, the cake is dislodged by tilting the trays. Representative types: The "Ogley," the "Ridgeway," the "Lesley," and the "Brown."

4. Machines consisting of a cylinder (a wheel) mounted upon a horizontal shaft and revolving, partially immersed, in the material to be filtered. This wheel is made with a number of vacuum compartments on its periphery, and is covered with filter cloth, or other material, usually protected by wires, or by some kind of metal fabric. Each peripheral compartment communicates, through hollow spokes, with a stationary valve. This valve is constructed and arranged so as to place the compartments into communication with a vacuum pump to withdraw the liquid, thus drawing the solids in this up to the cloth and thus forming the "cake." To facilitate removing the cake by a scraper or brush, compressed air can be forced through the cloth just before reaching the discharging point. In this way the cloth is cleaned also. Representative types: "Moore, 1902," "Oliver" and "Nicholas." The last named patent differs, inasmuch as it calls for the spraying of the pulp by means of a distributing launder.

5. Machines in which the main element is a wheel, carrying groups of filter leaves, which communicate with suction and compressed air mains, similar to those in Number 4. In this way the largest possible filtering surface can be obtained for a given floor space. Both sides of each filter leaf form effective filtering surfaces, but, in some cases, one side is steel-sheathed to facilitate discharging. The whole arrangement revolves partially immersed in the material to be filtered; the cakes are formed while the filter leaves pass through the liquid. Emerging from the pulp, the leaves are still kept under vacuum pressure to withdraw as much moisture as possible until approaching the discharging position. Here compressed air is forced into the leaves to discharge the cakes into a launder or conveyor. Each leaf when reaching that point is under a steep inclination. Representative types: "Fairchild" and the "Schorr."

6. Machines in which a belt of filtering fabric travels over one roller, or over a system of rollers, like a conveyor belt. The rollers are provided with a series of peripheral vacuum chambes; feeding and discharging mechanism are stationary. The modus operandi will be entirely plain. Representative types: The "Brunton" and the "Huntley."

The foregoing enumeration of the various designs will clearly illustrate the present state of the art. A great many other modifications are possible. Many of these machines have been given very thorough attention in the Mining and Scientific Press, the Engineering and Mining Journal and in Mines and Minerals, mostly during the years 1907 and 1908. My own machine, U. S. Patent 893,104, was fully described and illustrated in the Mining and Scientific Press of August 8th, 1908. In using such filters as dewaterers, only the operation is simplified, there being only two functions in the course of one rev-

olution, namely, first, cake forming and filtering, and second, the discharging of the dewatered, filtered product. The speed of rotation, the character of the material to be filtered, and of the filtering medium and the strength of the vacuum used, govern the capacity of the machine per square foot of effective filtering surface. The filtering media mostly employed are cloth, sand, charcoal and porous plates, and the strength of vacuum ranges from 5 to 24 inches of mercury, equal to approximately from 2.5 inches to 12 inches per square inch.

Considering all of these important, varying factors, it is not possible to give definite capacity data. As regards permeability or rate of filtration with a properly prepared, horizontal sand bed from 9 to 20 tons of water can be withdrawn per square foot of area, and in 24 hours, while one square foot of ordinary 8-ounce filter cloth will pass, under the same conditions, from 3 to 6 tons of water, or solution. It is obvious that sand cannot be used as filtering medium in many cases, unless provision can be made to prevent the admixture of sand while discharging the filtered material. In the filter designs, Numbers 4 and 5, the capacity per square foot of filter area is somewhat reduced, because the cake formation is in no way being assisted by the specific gravity of the material, as it is on horizontal filter beds. They offer, however, the advantage of a very large filtering surface on a limited floor space, and their cost per square foot, or per ton capacity, is much lower than that of other types.

For general work, it will be safe to assume for the same, as a preliminary, from 2 to 5 tons of water withdrawn per square foot, in 24 hours. The degree of dilution has also considerable influence upon the output. If the solid material suspended in the solution is very fibrous or spongy, poor results will be obtained unless the fibers are thoroughly cracked by disintegration. This is the case in many peat propositions, and, as the problem of dewatering cheaply is of great importance in that connection, it will be of interest to look into the probable economic results which may be expected by employing continuous filtering machines for this purpose.

Let us assume that 3,000 tons of wet peat, containing 90 per cent. of water and 300 tons of dry peat are to be filtered in 24 hours. The peat should be thoroughly disintegrated and pulped before pumped over to the filter plant. We expect that the filtered peat will still contain 60 per cent of moisture, although better results are quite probable with many types of peat. Consequently we shall get 750 tons of peat with 60 per cent. of moisture, and 2,250 tons of water will have to be removed in 24 hours. To safeguard against shut-downs we provide everything in duplicate, each unit being of sufficient size to handle fully 60 per cent. of the whole capacity or duty specified.

(*To be Continued*)

SOME FLORIDA PEAT PLANTS.

By Robert Ranson, of St. Augustine, Florida.

(Read at the Boston Meeting.)

In presenting an address to your Society, I am impressed, not only with the importance of the subject before us, but also with the vast responsibility which has been placed upon and accepted by the comparatively small body of men composing this organization. Whether measured by the standard of dollars and cents, or by that far greater and more important standard, in fact the only perfect one, the benefit of the world at large, we stand face to face with the solution of a problem of problems, than which I know of no greater given to man since the awakening of the race to the industrial conquest of our globe.

Wandering alone, often for days, through the almost trackless wastes of our thinly peopled state, with sounding rod in hand, over thousands of acres of marsh and bog, I am overawed in contemplation of the infinite resources of our earth and the wisdom of the Creator in his providence for the needs of man.

To be selected to assist in the development of such wealth and place it in the hands of man, is surely an honorable invitation and one to which we gladly respond.

Knowing what I do of the indefatigable efforts of the pioneers of the American Peat Society and their cheerful sacrifice of time and money, I am impressed that, not only in the conversion of heathen or the freeing of a state from the power of tyrants, do we find that spirit of devotion which always insures final success, but also, in the commoner walks of life, the simple digger of mud may, in his vocation or avocation, benefit the race, possibly as much as he who, with a liberal supply of rum and cannon balls, converts the simple African to Christianity and civilization.

In the perusal of the numerous essays convenient to our hand on "Peat," covering, say, the past ten years, I note with pleasure how very carefully the elementary principles of peat utilization have been dealt with, and that whatever book or treatise comes to hand, little or nothing is taken for granted as to the knowledge of the reader, but he is introduced again and again to the first principles of what may be termed "peatology." and, under the different language of each writer, becomes thoroughly grounded and prepared for the specialization of each new phase of the peat industry, when, as now, it begins to develop into its different legitimate functions. Whether taken separately or collectively, such painstaking works as those of Prof. Chas. A. Davis, Parmelee and McCourt, Erik Nyrstrom and others,

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*See "Commercial Aspects of Gasifying Peat," by R. Schorr, Journal American Peat Society, Vol. I, No. 4, January, 1909.

each introduces the novice to that fundamental study of peat in that thorough way, without which no science can be comprehended, and which, if not properly inculcated and absorbed by the student, results later in the avoidable errors and disappointments so often noted in these days of insane haste to reach a goal along some imaginary royal road, which never did nor ever can exist.

It has, in the past, been customary to hand over the study of peat as a whole, first to the geologist and then to the botanist, who, later, with the assistance of the chemist, have given to the world many useful results of patient investigation. Much of this, however, being purely speculative, has failed to interest the practical developer, and oftentimes has so crossed his actual experience as to incline him to discard theories set down as laws and lose interest in its scientific side.

On one occasion recently I was visited by a so-called peat expert, from whom I had expected great help, but was woefully disappointed in his passing over without comment all the operations of excavation and manufacture which had cost me years of study to perfect and which, at that time were working like a clock, to study a species of vegetable growth which he happened to observe for the first time in that locality. As a matter of fact, it had been sprouting each spring and dying each autumn since the time Noah had stepped out of the Ark.

Prof. A. C. Lane, State Geologist of Michigan, in introducing Professor Davis' work on peat, notes that it is the fruit of a happy marriage of botany with geology, and this expresses well the work of the ideal investigator, needed in the study of peat, and points our students in the right direction. Without desiring to flatter our friend Davis, I must say from personal experience that he has been of immense help to me, and doubtless to many others, in further pushing the chemical and manufacturing phases to the front, and stands today, in my estimation, as our foremost leader, and we are all glad to see him occupying the position he does in Washington.

I am reminded of a certain experience in former years, where I made a failure in agriculture, and in relating the same to an old friend, he quietly remarked that we learned more by our failures than by our successes. If this is true, I must be a very learned man. My experience in peat has been limited to the state of Florida, the land noted for the poverty of its soil and the salubrity of its climate. In this narrow sphere of 69,200 square miles, I think we have probably 12,000 square miles of marshy lands containing vast peat deposits, of varying depth and quality, in spite of the oft repeated assertion of the encyclopedia writers, doubtless copied from the original, that no peat exists in tropical, or semi-tropical, countries; denying which, I show you samples which, if not peat, have all its constituents in varying degrees and which I have proved to be of immense

value commercially, both for fuel and for fertilizer material, especially on lands deficient in humus, so necessary to successful plant growth.

My earlier struggles and accompanying loss of blood and shedding of tears, dating from 1897 to 1906, I will pass in silence, not wishing to harrow your feelings. They consisted of fruitless journeys in search of peat El Dorados, considerable absorption by my system of malaria of all grades, followed by violent fevers brought on by drinking pond water, brown and tepid under tropical suns; falling to my armpits into alligator holes, and often coming face to face with the cotton-mouthed moccasin snake, waiting in unexpected places to be stepped on; to say nothing of the jigger, flea and various ungezifer.

Later, figuring on raising impossible funds to build impractical machinery and then, on the complete exhaustion of finances and with numerous unpaid bills disturbing the night's rest, back to legitimate work to raise more funds for more investigations.

Later, when a good location had been discovered and purchased and a company formed, certain bright minds who had contributed but little cash but large amounts of hot air, sought by increased contributions of the same heated atmosphere to swallow the whole thing in its half baked condition and turn me adrift to starve or occupy a modest niche in the temple of obscurity. On one occasion, after days of careful maneuvering, I was able to entrap a real live millionaire, who came in a $6,000 automobile, and spent a whole half hour of his valuable time in my workshop, investigating and encouraging me. After ten days of alternate hope and fear as to the results, I got a letter from his secretary regretting that, owing to the urgent calls made upon his purse, to supply suspenders to the African heathen, he was unable, at that time, to invest in any new enterprises.

About Christmas, 1906, I managed to raise about $6,000, which purchased a first-class pugging outfit, as used by brickmakers; boilers and engine, and sufficient other crude machinery to excavate, pug and dry in the open air, about ten tons of peat a day—that is, in theorem. In practicum, bad weather, floods, ignorance of the nature of peat and its remarkable faculty of doing just what you least expect, my output at the end of sixty days was about fifty tons of imperfectly dried peat. About this time I became aware of its possibilities as a fertilizer material and I went North to look into the matter. On my return from the inspection of two plants in New Jersey and one in New York, we raised an additional $15,000 and put in the necessary machinery, including a large direct-heat drier, and also much improved the fuel part of the plant.

The money was promised, but came in so slowly, on account of the panic of October, 1907, that it was a time of ex-

treme anxiety and the many opportunities of economy offered to the possessors of ready cash were lost by being compelled to ask for long credits.

By February, 1908, I was turning out a superior class of fuel and filler and selling the latter at $6.00 per ton f. o. b. the factory, twenty miles from market. I made several shipments up to June 1st, when I was superseded in the management on the supposition that a new manager could get a larger output. In about two months they tore up the plant, at an expense of about $6,000, and then burnt it up on August 30th, without any insurance, the result of careless handling.

This deposit of peat is the best I have found anywhere, being about 26 feet deep, black in color and analyzing well for both fuel and filler, and being only twenty miles from Jacksonville, so that the plant will doubtless be rebuilt on improved lines in the near future.

Seeing no immediate chances of rebuilding this first plant, I began figuring on a second one about 60 miles farther south, and commenced operations there about the first of October, on improved methods, though much hampered through having to follow the ideas of people who knew absolutely nothing of the business, and accordingly the estimates were somewhat exceeded. This plant was completed in March, and my tests of it were satisfactory. After running for about two months the party appointed general manager concluded to alter it, and when I visited the plant about a month ago, it was so torn up that I almost failed to recognize it.

The building of what I think the best and simplest soft coal gas-producer I have ever seen, which we have recently tested with peat and for which I predict a great sale in the South, will doubtless increase the use of peat for fuel. My experience in getting out a high grade of filler in the best of condition, warrants me, I think, in building a third plant, eliminating some former errors, and with that end in view, I am now at work designing and building a very complete fuel and filler plant, about a mile north of the city of Palatka, Florida, with excellent transportation facilities by rail and water and with about 175 acres of as good a peat bog as I have ever seen. A general description of my methods will interest you without doubt. In all cases I have preferred to work the bogs lying along the banks of the St. John's river, a noble stream of water about 300 miles long, and deep and wide.

Our peat, therefore, is all below water, and I find it is more dense, and richer in nitrogen, than that found in bogs that are dry. The so-called dry bogs are located inland, considerably above tide water levels, and in times of great flood are covered several feet deep with water, while in dry times, the water often recedes to a depth of eight or ten feet. The peat thus produced

is altogether different from that which is constantly submerged, and the alternate wetting and drying seems to so interfere with that gradual decay, or growth, which forms the peat,, as to produce an inferior quality of the same. I therefore use an ordinary bucket dredge, with either a clam-shell or orange-peel dipper; I prefer the orange-peel type, but, on account of short life, they are too expensive.

(To be Continued)

PEAT AND THE PRODUCTION OF POWER.

By Herbert Philipp, Perth Amboy, N. J.

(Read at the Meeting of the New York Section, Feb. 13th, 1909.)

The greatest future for the extensive use of our peat bogs lies in the conversion of peat into energy for industrial purposes, either by establishing central power plants at the bogs and distributing electrical energy from these centers, or by locating industries tries near enough to the bogs to prevent the encumbrance of any unnecessary cost by the transportation of the peat.

It is barely two decades ago since the industry of Europe considered it impossible to use peat as a fuel, as long as the price of coal did not exceed $2.50 per ton, and hitherto the employment of peat as fuel for power generating purposes has been insignificant. The reason that peat has found so little use here in North America is not because of its poor heating value, which is somewhat compensated by the facility of procuring it, but because of the large number of failures of concerns which intended to manufacture peat for fuel purposes, their failure being due to the ill-advised, large speculation into processes which were mere laboratory experiments; the want of processes of economic value for drying peat, or of processes for using it wet, and of gasifying peat. The large number of failures have made capitalists suspicious of investing in peat factories, and they have become afraid to invest one cent in peat interests. However, now that in Europe such successful results are being produced, many inquiries and more general interest is being shown for the development of the bogs and the conversion of peat into power.

The peat found in the different bogs varies extensively and also the results obtained from that from the same bog are just as variable.

Peat in the bog can contain moisture up to or above 90 per cent., and the separation of this large amount of water from the peat has formed one of the drawbacks in making use of peat. Today there are several very efficient and cheap processes in use for drying peat, yet air-dried peat seldom contains less than 15 to 20 per cent. free moisture, depending very much on the climatic conditions. Further drying of the air dried peat can

be accomplished by using the sensible heat in the liberated gas, in cases where peat is gasified, or in the flue gases where it is used under boilers.

The ash in peat also forms an important item and is very variable, often so in the peat from the same region, and there are also equally great differences in its composition. It is rare that peat-ash represents merely the mineral constituents of the plants from whose remains the peat has been formed. It contains also mineral matter carried by the water, mechanically or chemically, which permeates the bog, and the composition of the ash is also generally influenced by the nature of the prevailing rocks in the neighborhood of the peat deposits.

To illustrate the varying ash content of peat, the following figures might be of interest. In Wood of Allen, Ireland, the peat contains 2.0 to 8.0 per cent. ash. Mulder reports peat in Friesland, Germany, as containing 1 to 4 per cent. ash. Peat of Baden, Germany, is reported by Petersen to contain 0.9 to 14.8 per cent. ash. Maisilly states that peat from Department d'Oise, France, tested 6.7 to 14 per cent. ash. In New Jersey, within thirty miles from here, there are several peat deposits, which could be used for fuel purposes, testing 5 to 15 per cent. ash. This ash content is very important in determining the value of a peat deposit for fuel purposes, and it is always desirable to make a large practical test for the ash, in investigating a peat bog for its value as a fuel.

The composition of the ash varies greatly, as has been stated, yet in the majority of the fuel peats which have come to my attention the ash contains 80 to 90 per cent. silica, traces of sulphur, except from salt water peats, which generally contain large quantities of sulphur; also alumina and small quantities of lime, showing that there is very little in the ash to form clinkers.

In determining the calorific value of peat, it is preferable to make direct determinations in a calorimeter than rely on Dulong's formula, as determinations by this formula invariably give results 6 to 10 per cent. too low.

We have two distinct ways in using peat for power and heating purposes; first, by firing it directly under boilers, or into furnaces, and second, by gasifying it.

For direct firing, peat is used in large first-size pieces, or in the form of briquets. Peat which disintegrates very much on drying has to be briquetted, especially if it has to be transported any distance from the factory; briquetting can be done without any additional binder and at a very low cost. In cases where the peat disintegrates and dusts easily, it can be, if used at the factory, burnt under a boiler by a powder firing apparatus.

For firing on grates, several characteristic properties of peat

have to be taken into consideration. Peat is specifically much lighter than coal, and requires more work to keep an efficient heavy fire-bed than when coal is used. This also increasees the labor for hand firing, not only because the heating value of the peat is slightly less than coal, but on account of its bulkiness one man cannot fire the same amount of peat in a given interval as he could coal. These difficulties are overcome by using a step-grate with mechanical feeding, as is stated below. The grate-bars on an ordinary grate have also to be placed closer together, because peat ash does not generally clinker and the ash would fall into the pit too easily, and then the burning peat, which disintegrates easily, would fall through, and a considerable loss would be sustained by the unconsumed carbon in the ash.

The step-grate is very decidedly more economical for the firing of peat direct under the boilers, or even for the direct firing of open furnaces; and the addition of apparatus for the mechanical feeding of peat can be used more effectively than with the plain grate; neither is there so much loss of heat sustained by unconsumed carbon falling through the grate bars, yet the loss of heat in the ash is as great as in the other.

The moisture of air-dried peat for fuel purposes is on an average 15 per cent., and in Sweden* practical use is made of the sensible heat of the flue gases to expel more moisture. In Timsfors and also in Rydboholm the flue gases circulate directly around the peat in a specially constructed over. In bad weather, when the chimney draft is poor, fans are used to draw off gases through the flues. It is best to have two such ovens, which can be used alternately.

Peat briquetes generally show a slightly higher value in heat units than the unbriquetted peat. Samples of American peat fuel with 12 to 18 per cent. moisture have shown 9,000 to to 10,000 B. t. u., and if the peat is dried better by artificial means it shows 10,500 to 11,500 B. t. u. and over. This is very favorable, as coal used for industrial purposes has generally only from 12,000 to 13,000 B. t. u. Taking into consideration the low price per unit that peat costs when used at place of production, it fully compensates for the missing heat units.

Of course enough peat has to be dug up in the seven or eight working months to keep a power plant fully supplied for the balance of the year; this is rather a drawback, as it necessitates the erection of large storage sheds in which to house the peat. One thing is of interest in regard to the storing of peat, and that is that the owner of a pile of peat does not suffer from the possibilities of spontaneous combustion, as is the case in storing coal.

We now come to the gasification of peat, which can be divided into two chapters: Dry distillation of peat (external heat-

*Schreiber. Oest. Moorztsch. 1908 p. 161.

ing), and secondly, the gasification of peat by internal combustion.

The dry distillation, or coking, of peat, was tried very many years ago, but failed on account of the peat-coke being too soft for metallurgical uses. The Swede, Ekelund, was the first one to obtain the condensation products from dry distillation of peat and to use the distillation gases for heating purposes, but owing to the poor grade of coke he obtained, and fluctuating prices of the condensation products, he did not follow up his work. A few years later the German, Martin Ziegler, started practically the same process that Ekelund had given up, but through his previous experience with soft coal distillation and more perseverance, he has built up a successful and practical process. Ziegler obtains a hard coke, which finds use in metallurgical processes, by using dry peat briquetted under high pressure; and all of the condensation products are purified or used as raw materials in other processes. The uncondensed gases are used for heating the retorts. Although Ziegler deserves much credit in achieving success in the distillation of peat, it can hardly be considered as a factor in the production of power from peat. Yet the production of coke in conjunction with a gasification plant by internal combustion would form a plausible and practical possibility. I hope at some later time to prepare a paper on this subject and the seven similar processes, and I shall now pass on to the very important and interesting subject of the gasification of peat by internal combustion.

The gasification of peat by internal combustion can also be classified under two heads: The production of producer gas from dry peat, and the production of producer gas and ammonia recovery from wet peat.

The production of producer gas from peat is not so very new, as, since about 1872, the Moltala Steel Works in Sweden have been using producer gas made from peat. The peat gas costs them somewhat more than coal gas would, owing to the fact that the peat has to be transported across Lake Wetter in sailing vessels and then by railroad to the works, but on account of the negligible amount of sulphur and phosphorus present in it, they find it desirable to use it in their open hearth and puddling furnaces. In their rolling mill, it is especially noted that thin steel plates scale less when fired with peat gas.

The making of peat producer gas is governed by similar laws and rules as in the manufacture of producer gas from coal. There are several well known systems for gasifying fuel, which differ chiefly in shape, and position of air and steam inlets. In producing gas from peat, a large fuel bed is required, varying in size from 5 to 8 feet, according to the specific gravity and size of peat used. The size of the peat should not be too big, and it does no harm if it disintegrates, as long as it does not

become too dense to prevent the steam, air and formed gases from passing freely through the fire-bed. In fact, the finer divided the fuel and the greater the depth of incandescent carbon, the more favorable are the chances for the formation of a high per cent. of carbon monoxide. In cases where fuel-beds of necessary depth cannot be obtained, or where peat with low specific gravity is used, the formation of carbon monoxide can be enhanced by reducing the velocity of the gases; in other words, by a weaker draft and blast, thus prolonging the contact of the gases with the fuel-bed. The air and steam, entering the producer, come in contact with incandescent peat and form carbonic acid and hydrogen. The heat generated by this reaction is taken up by this mixture of gases, which heat again is absorbed by the peat above this incandescent zone. The carbonic acid and hydrogen are converted into carbon monoxide and partly methane by glowing carbon. The top zone is, however, hot enough to liberate and decompose many of the condensible peat products into combustible gases. We therefore find olefiant gas in peat producer-gas.

The peat gas, when it comes from the producer, has still a high temperature, and this sensible heat can be very valuably used for further drying the air-dried peat, which is being fed to the producer. This can be accomplished either by bringing the peat directly in contact with the gases, as it is uniformly fed into the producer, or by indirectly circulating the hot gases around ovens constructed of sheet iron.

Points for the efficient working of a peat gas producer are a high temperature in the first three or four feet of the fuel bed, regular feeding of the peat, feeding the correct proportion of steam, and a good air blast; both of these latter as a low pressure.

A good average peat gives 40 to 45 cubic feet producer-gas per pound of peat (dry), with a heating value of 160 to 200 B. t u. per cubic foot.

I now arrive at the gasification of wet peat. Some two or three years ago, at the instigation of Dr. Mond, of England, Frank and Caro undertook the study of the gasification of wet peat in the Mond producer, and the recovery of the peat nitrogen content as ammonia. Satisfactory results have been obtained in these producers in England, Germany and France; and Woltereck reports a similar process to have also obtained good yields.

Inasmuch as descriptions of these processes have been extensively published, I shall not go into details here. Peat containing 50 to 55 per cent. water was used, and in the tests carried out at Stockton and Winnington, 70 per cent. of the nitrogen in the peat was recovered as ammonium sulphate.

The favorable results of Frank and Caro have already in-

duced capitalists to erect a Mond gas plant for peat gasification and ammonia recovery at Herne, in Westphalia, Germany.

This plant, at Mont Cenis Colliery, in Westphalia, has been designed and erected by the Power-Gas Corporation, Ltd., of England, which has been experimenting for many years to apply the Mond process to the gasification of peat. The success which has marked their endeavors has been so favorable that three installations are now nearly completed—one in the county of Norfolk, England; one in Italy, and the third in Germany.

Results which they have published state that the peat with 40 to 60 per cent. moisture was used, and per ton of dry peat, containing 1 per cent. nitrogen, gasified, they obtained about 80 pounds sulphate of ammonia and 80,000 to 85,000 cubic feet of good power gas, testing 150 B. t. u. per cubic foot.

Another large installation for the gasification of peat and recovery of ammonia, by the same process, is now in course of erection in the northwest of Germany. This central generating plant, which controls about 16,000 acres of peat land, is designed to distribute electrical energy over a wide area for agricultural purposes, as also for the provision of light and power in a number of towns situated within a radius of 40 to 50 miles from the power plant.

It is estimated that by means of the large gas engine, work to the extent of 600 hore-power hours will be obtained from each ton, while the value of the ammonia recovered is estimated to yield a good interest on the investment.

The vast peat resources in North America are undoubtedly well known to you all, and the fact that many of the deposits are situated where the price of coal almost demands their utilization today, will, I hope, stimulate capitalistic judgment into developing this profitable industry for the benefit of itself and the public.

I should still like to mention that the majority of peat deposits in North America show a higher heat value than the European deposits are reported to have, so that we can only look forward to more favorable results than they are obtaining over there.

A REPORT ON THE MILNE PROCESS FOR MAKING PEAT FUEL.

Dr. J. McWilliam, London, Ont.

(Read at the Boston Meeting.)

At the organization of the American Peat Society, at the Jamestown Exposition, in October, 1907, a short account of the Milne process was given in a paper entitled "How to Dry Peat Fuel," and this present paper is a statement of our progress with this plan during the last two seasons.

By this plan, the surface of the drained bog is harrowed, the roots removed and the dry peat is loaded on a car by means of a suction fan, mounted on a car running on a railway track, laid on the surface of the bog, both the motor of the car and of the suction fan being operated by electricity taken from overhead wire, by means of a trolley pole.

It is a fact that a quarter to a half inch of peat will dry down to a moisture content of from 25 to 30 per cent., in from 2 to 6 hours after being harrowed, if the sun and wind conditions are favorable. The dust, after collection, is passed through a drier, heated by exhaust steam and stack gases, to reduce the moisture to from 8 to 15 per cent. From the drier it is passed into a press, which turns it into briquets, of which three and a fourth weigh a pound.

Since 1907, the work has been largely experimental; in 1908, we tried firing with peat dust. In the opinion of the writer, this is feasible for generating power, but the preparation of the dust requires a special drier and a special grinder, and, up to the present time, and so far as we were able to try it, the method was only a partial success; peat dust, dry enough to press into fuel briquets, was not dry enough for dust firing and to get the power out of peat dust as fuel, fed under the boiler with a fan, it must be ground very fine; while we had several choppers, none were found to be exactly suitable for grinding the peat, and, as wood was plentiful and cheap, and as peat briquets make a good steam fuel, we have abandoned the firing with dust for the present. The writer still believes, however, that if the finest part of the dust were screened out before drying, and put through a special drier, which would reduce the moisture to 5 per cent. or less, that firing with peat dust would be a cheap and rapid method of raising steam and thus producing power.

Four years of experience with a Simpson hot air drier convinced us that it was impracticable to use it in drying peat powder. It consisted of two iron tubes, 30 feet long and 34 inches in diameter, carrying on the walls inside, lifters which carried the peat dust up the sides and showered it down to the center of the tube with each revolution. The tubes were heated by fires under the lower tube and fed from one to the other and were set at an incline of 18 inches for the 30 feet. There were several objections, in practice; first, the tubes took a lot of fuel to heat them, and were often on fire; second, much of the fine peat dust went up through the smoke-stack. Although unable to be accurate in the matter, in the opinion of the writer, at least 25 per cent. of the peat dust was lost in this way, and as the coarsest and wettest portions of the peat were left, the drying was made more expensive.

To remedy this weakness in the plan, a drier has been de-

vised and installed during this past summer and the whole factory has been built over to suit it. The writer regrets that he is unable to give a complete report as to the virtue of this drier, as it was only in a state to try it, less than a week ago. From the tests made, however, we feel confident that it will do the work satisfactorily. A short description of this drier will form the subject of another paper presented at this meeting.

With regard to the commercial success of the method, the writer has every confidence. He has no patent rights in the method, nor any interest in any patent relating to it, and expects to get his money back by making peat fuel and selling it; he has no company to pay dividends to and no stock to sell. The grounds upon which he builds his expectations are, first, the collector has always been a success, and the dust can be put in the storehouse, or in the press, at a cost for wages of not more than 25 cents per ton and at a fuel cost of from 10 to 15 cents per ton. With our new drier, there is very little further cost if the press and collector run simultaneously; if the press is run alone, the wage cost is increased by 50 to 60 cents per ton, with a fuel cost of 10 cents per ton.

The fuel sells readily at the factory for $4.00 per ton; our capacity is probably 15 tons daily, though will still require some weeks to determine.

The criticisms which reasonably apply to this method are, first, the large capital required to install a plant, from $10,000 to $15,000 being required to install a plant of 12 to 15 tons daily output, and second, the shortness of the working season.

To the first, I would reply that I believe the machinery can be very much simplified and made more effective and much cheaper; even if this could not be done I believe a factory equipped with it will pay good interest or dividends on the investment as it is.

The shortness of the season applies to many standard industries more or less, as brick-making, lumbering, etc., and if a factory will pay wages, expenses and dividends, that is all that any industry will do. The writer does not claim that this method of making peat fuel is the only way nor that it is the best way; he sincerely hopes that it is neither one, but he does claim that it is a method which will pay; that it ought to be still further developed and improved; that it makes a clean, hard, good-shipping product and that it offers one satisfactory solution of what is proving to be a very difficult problem.

PEAT EXHIBITION AND MEETING IN NEW YORK.

As previously announced, the New York section of this society held an exhibition and meeting at the Chemists' Club, West 53rd Street, on Monday and Tuesday, May 16 and 17. The exhibition was a very representative one and contained

examples of most of the products that have been made from peat in this country and some typical specimens from Europe. Peat fuels were especially well represented and equally well shown. The fuel and other specimens were spread on tables, properly classified and carefully labeled, while drawings, blue prints, plans of machinery and plants, books and similar exhibits added to the interest and value of the collection. The exhibit was open to visitors all day Monday and Tuesday.

The meeting was held on Tuesday evening and called out a larger attendance than any previous meeting of the society. The program consisted of an opening address by Dr. Charles W. McKenna, Vice-President of the New York Section; a paper, entitled "Our Peat Bogs, a Valuable Asset," by Professor Charles A. Davis, and short addresses by Mr. A. Anrep, Jr., of the Canada Department of Mines; Mr. Philip Hesseltine, of Chicago, Ills., and others present, who were called on for impromptu statements in answer to questions which arose during the discussion following the paper.

The interest shown at the meeting was very great and it was well along towards 11 o'clock before adjournment and still later when the last interested visitor took his departure. The meeting was in charge of a committee consisting of Dr. Charles W. McKenna, Mr. J. H. Hoff, Dr. O. K. Zwingenberger and Mr. Julius Bordollo.

Irish Peat Industries.

It is difficult to foresee what a far-reaching influence a small and apparently trivial act may have. When the announcement of the meeting of the New York Section for May 16 and 17 was being sent out, some one who receiveed a copy of the newspaper announcement, sent it to the editor of the Irish Industrial Journal; this is a weekly journal, published in Dublin, energetically devoted to developing a sentiment in the minds of its readers, that home industries should be developed by patronizing them, and that Irish products, when as good as others, should be used by the Irish people, instead of those from abroad. This is good doctrine and has been the cause of much of the prosperity of the people of the United States. The result of the casual sending of the item mentioned above is told in the story below, quoted from the Irish Industrial Journal of June 4, 1910. (Vol. 1, No. 23.)

"An esteemed correspondent in America sends us the following cutting from the New York Evening Post of May 13th, 1910, and asks: 'What are you doing with the enormous wealth hidden in the "peat bogs" of Ireland?':—'Peat and its products will be exhibited at the rooms of the Chemists' Club, No. 108 West Fifty-fifth street, on the evenings of Monday and Tuesday, and exhibits will be designed to show that the cheapest

gas for power and light can be produced by the material and to illustrate what enormous wealth is hidden in the peat beds of New York, New Jersey, New England, and the North West. On Tuesday evening Professor Charles A. Davis, of the United States Geological Survey, will present a paper on 'Our Peat Bogs a Valuable Asset.'

"The answer is very little. The National Peat Industry Company, whose head office is in Newcastle-on-Tyne, have a factory in Monasterevan for the preparation of peat moss litter. This appears to be the only firm utilizing peat for manufacturing purposes at present. There were one or two other companies, but they have given up the business.

"One company, the Electro Peat Syndicate, whose affairs were the subject of legal proceedings recently, put down a very extensive plant on the bog at Kilberry, in County Kildare, for the manufacture of different products. One specialty which they were experimenting upon was a substitute for coal, which they expected to be able to sell at six shillings a ton.

"No money was spared in trying to make the experiment a success. Most expensive machinery was put down. One man received about £150 for the haulage of the machinery alone from the adjoining railway stations to the works. This shows how complete the plant and preparations were. Experts were brought from Germany to look after the work, with the superintendent, Captain Verey, R. E., and experiments were carried out for over a year. Large shipping companies, on the strength of samples submitted to them and representations made to them, promised some very large contracts for fuel.

"The company, however, after over a year's working, found that the experiments were a failure. The peat coal, which was made in blocks about the size of building bricks, looked like coal and burned well. While it was new it was as good as coal, but when kept for any length of time it crumbled away and became like so much slack or dust, unless it was kept free from moisture. All efforts to overcome this defect failed, and this, we believe, is the reason why the project was abandoned.

"If kept dry it would last well. Mr. Henry Hosie, a very large and successful farmer near Athy, and who keeps five traction engines, used some of the peat manufactured at Kilberry, and found it a fine steam fuel, and this practical farmer believes that if the company had sufficient capital to go on with, they would have made the venture a success, and as a lot of the company's capital was expended on the fine buildings erected, it might be worth the attention of enterprising speculators to go further with the matter.

"The company, of which the Earl of Mayo was chairman, started with a great flourish and with good prospects, but it failed to realize the great hopes entertained of making money

out of the bogs of Ireland. Another company, started on a smaller scale, made paper from peat; but this comapny also failed to make the business pay. So far as the utilization of peat for manufacturing purposes is concerned, these experiments are not encouraging.

"There are other ways, however, in which we might be able to use the bogs to advantage. In an article published in our issue of April 9th, a geologist, who is an expert in soils and a practical farmer, wrote: 'Great possibilities also exist with regard to the agricultural development of the bogs of Ireland. One-seventh of the entire area of the country consists of bog-lands—one bog alone, the Bog of Allen, has an area of 240 square miles, and extends across the Central Plain, almost from Dublin to the Shannon.

"'This immense area is at present a sterile waste, and no serious effort has ever been made to bring it under cultivation. The success which has attended the efforts to reclaim similar bog lands in Bavaria, Austria, and other continental countries, where they have been made to produce remunerative crops of potatoes, roots, vegetables, etc., would indicate that the reclamation of our bogs is not by any means of insuperable difficulty. Reafforesting the bog-lands is another possible way in which they may be turned to good account.

"'Attempts at planting them have been made in the past, but unfortunately with little success. Yet, it is certain that peat, under specific conditions, does not form an unfavorable soil for forest growth. In support of this statement, a succession of several buried forests have been found in the bogs of Schleswig Holstein, Norway, etc., and in Irish bogs, buried forests of oak, with roots penetrating into the mineral sub-soil, and higher up in the peat layers dead forests of deal are to be seen. These trees must have flourished under climatic conditions not so very different from those that prevail at the present day. It should be well worthy of scientific investigation, whether by any system of treatment if it be possible to make the peat lands of Ireland once more suitable for forestial purposes.'

"Our contributor suggested that this was a matter which was worthy of the attention of the Department of Agriculture and Technical Instruction. Kildare, which through its county council is giving a lead to the whole of Ireland in afforestation, also provides us with evidence in support of our contributor's suggestion. The late Mr. James Heffernan, Rathconnell Wood, near Kildare, successfully planted several acres of bog with deal, spruce and larch. One patch of about an acre in extent in the very centre of the bog is now a prominent land-mark and known as Derryweeleen. Some good timber has recently been sold off this plot, and there is a fine undergrowth and a good rank grass growing there at present."

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EDITORIAL NOTES.

The Fourth Annual Meeting.—By the time this number of the Journal reaches its readers, the date of the Fourth Annual Meeting, July 25-27, will be close at hand and all arrangements for its success will have been completed. At the time of writing this notice, the preliminary announcements are nearly ready for distribution and the tentative program is an extremely strong and attractive one to all who are interested in the possibilities of using peat for fuel, or far any purpose.

The opportunity to see a well equipped and thoroughly developed peat fuel plant in full operation, under skilled management and at the end of a season's run, is alone worth the trip to Ottawa to any person who contempates manufacturing peat fuel; when, in addition to this, he can see what is probably the only gas-producer designed and built to use peat fuel in North America, in full operation on peat fuel, and can have the benefit of a special program on various phases of peat utilization as well, he certainly should feel that the chance is too good to miss.

The meeting will assuredly be the most practical one yet held by the Society and every member should attend it and get the full benefit of what is to be seen and heard.

The plant for making peat fuel is, as is generally known; on a bog which has been drained,and machine peat is being made by the use of European machinery and methods, under the direction of Mr. A. Anrep, Jr., who is so well and favorably known to those members of the American Peat Society who have attended recent meetings. Let us make this meeting the most successful, in point of attendance, of any yet held by the Society, as it will be in interest. This can be done if each one make the effort to be present.

Power-Generation from Peat.—Notes relating to the great central power station in Germany still continue to be printed in prominent newspapers and technical journals. This generating plant has already been described in this Journal and this comment is made simply to call attention again to the fact that there is a general interest in peat and its possibilities as fuel.

Peat Paper Plant for Indiana.—A report has been received that Mr. John E. Baker, of the John E. Baker Moss Co., Garrett, Ind., is interested in the development of a local peat paper plant, to be known as the Garrett Paper Company.

The Minnesota Peat Fuel Company, according to clippings from the newspaper press of the state, has been incorporated under the laws of Minnesota, with the following officers: C. A. Johnson, St. Peter, President; N. M. Sears, St. Paul, Vice-President; E. W. Ziegler. St. Paul, Secretary and Treasurer; C. H. Carpenter, General Manager. The capital of the company is given as $300,000 and it is reported that the company has secured the exclusive rights to a briquet machine, and purchased two of the machines, with a capacity of 75 tons each per hour. They expect to make 300 tons of briquets per day, and the plant, when completed, will cost about $75,000 and will give employment to about 35 men. The plant will be located at or near St. Peter, Minn. The report further states that the peat has been tested in Chicago and makes very satisfactory briquets, and that, if there is no hitch in the plans, the factory will be erected during the coming summer and the company will begin business in September. The officers are said to plan to make the St. Peter plant the first of a chain of similar factories.

Newspaper Clippings, upon which the editor of this Journal has to base many of the statements relating to new, or projected, plants, which are published as notes, are exceedingly unsatisfactory sources of information, except as to such principal facts as the formation, or incorporation of new companies, the amount of capital stated in the articles of incorporation or the names of the officers, and the members of the Society are once again asked to send in corrections to any misstatements which

may appear as the result of such quotation, if they are unwilling to furnish information at first hands. It is apparent, for example, that there are some errors in the figures given in the item regarding the Minnesota Peat Fuel Co., since, if the machines mentioned have a capacity of 75 tons an hour, which seems an impossible output for any form of machinery, but especially for a briquetting press, then the total amount of fuel turned out by one press would be 750 tons per ten-hour day, and 1,500 tons by the two presses with which, it is reported, the plant is to be equipped. Instead of this quantity, the capacity of the new plant will be only 375 tons, or the output of the machines for about two and a half hours. Another matter difficult to understand in these items is the small sum, $75,000, which it will take to erect the plant of the capacity given, for it is well known that briquetting plants are very expensive, when the cost of all the absolutely necessary machinery is taken into account, with mechanical excavators, driers, electric machinery, boilers, engines, railway tracks, cars, conveyors, etc., all of which must be of a capacity sufficient to handle the large amounts of raw, wet peat necessary to keep the briquetting presses supplied with 375 tons of dry material, which they must have to turn out that amount of product.

It is evident, therefore, that the figures quoted from the newspaper items are not correct, and the obvious lesson is, that those who wish correct accounts of their enterprises published in this Journal should send their statements to the editor directly.

Vermont Peat Deposits.—But little has been heard from Vermont as a peat-bearing state, hence the following note from the Burlington Daily News of May 19th, will be of interest: "'Vermont has peat to burn'—using the slang phrase in its literal meaning. There are few towns in the state, according to our State Geologist, Prof. G. H. Perkins, which do not possess at least one peat bed and many of them several. 'It is not by any means impossible,' says the same authority, 'that, on many of our farms which today yield but poor returns for the labor spent upon them, there are peat beds that may, with improved methods of preparation and use, prove much more remunerative than the crops which are now raised on what are regarded as the more valuable parts of the farm.' Some of the most extensive peat deposits in Vermont are in South Bennington, right at our doors, South Hero, Pearl Isle, Lamotte, Benson, Monkton, etc. The most extensive deposit is at Bristol Pond. A good many beds exist without the knowledge of their owners, it seems, and thorough investigation would no doubt bring to light more peat than there is in all Ireland, where it has been utilized for fuel for ages. In this respect the Emerald Isle leads the way for Vermont and the United States. As

coal gets constantly more expensive, our peat beds may have to be relied upon for heating our houses and for making power."

The Zwingenberger Gas-Producer, described and figured in this Journal, has been built and tested on Dakota lignites by a Minnesota company who are well pleased with the results and will manufacture it in standard sizes and place it on the market at once, it is understood, for both lignite and peat. In this connection it may be said there are now several manufacturers of gas-producers for using bituminous fuel, who are advertising that their producers will work satisfactorily with peat, and it is undoubtedly true that if peat fuel could be had in large enough quantities for authentic long runs and carefully conducted tests, there are many parts of the country where peat would soon become a staple fuel, from which producer gas would be generated for running electric light and power plants, the burning of brick and lime and for metallurgical purposes.

The Study of the Peat Bogs of Canada, to find out their extent and determine the quality and quantity of the peat which they contain, begun a number of years ago by the Mines Branch, Canada Department of Mines, will be continued by Mr. A. Anrep, Jr., after closing the season's operations at the peat fuel plant at Alfred, about the first of August.

The United States Bureau of Mines, recently established by Act of Congress, will continue, and doubtless extend the work begun by the Technologic Branch of the U. S. Geological Survey, after July 1, 1910, except the testing of structural materials (cements, concrete, brick, etc.) for the U. S. Government, which work was transferred to the U. S. Bureau of Standards, together with all the equipment which had been gathered by the Geological Survey for structural materials investigation.

The fuel testing work and investigations into the cause, and the methods of prevention of coal mine accidents and mine rescue work, heretofore carried on by the Technologic Branch, will be continued by the new Bureau of Mines. No program of work, other than the continuation of the investigations already begun, has yet been announced.

Canadian Government Peat Plants.—A despatch dated Ottawa, June 2d, states that "the Peat Experiment Station at Alfred, Ontario, has been so successful that the government is now considering the question of establishing similar stations in other parts of the country. One of the objects is to supply not only the farmers of the prairies, but the rest of the people of Canada, with fuel in order to make them independent of the coal supply of the United States."

On June 24th, Mr. Anrep wrote that he had produced 650 tons of peat, containing 25 per cent. moisture, the plant having been started about the middle of May. This was in spite of the very unfavorable weather conditions of the early part of June.

The cost of production is given in a printed statement issued by the Department of Mines, as from $1.75 to $1.80 per ton, at the railroad station, and this cost includes all charges that can be properly made against the product. These figures are important, because of the relatively high price paid for labor, the 14 men employed receiving $1.75 per day and their dinners, or an equivalent to at least $2.00 per day.

It is evident from such figures that it will not be so difficult as has been imagined to make air-dried machine peat by the best European methods, and at a price low enough to yield a fair profit, even if wages in America are high. The principal essentials to be taken into account seem to be that the man in charge shall have experience, that the plant shall be fully equipped and have working capital enough to permit its being run efficiently.

The International Power and Manufacturing Company, 88 Broad Street (room 215), Boston, Mass., organized under the laws of Maine, with E. E. Hedges, President, and C. B. Ayling, Treasurer, is sending out a little booklet, entitled "The Solution of the Fuel Problem." From this brochure it appears that the capital of the company is $1,000,000, divided into 100,000 shares, each with a par value of $10.00. The reader is assured that the company will own and control its machinery, and that it can erect 300 plants in different parts of the United States and Canada and the output from all of them would find a ready market at the same price as coal. "Every additional plant will add at least 500 tons a day with profit accordingly." There is a suggestion that the process proposed is one for briquetting, but no mention is made as to where the first plant can be seen in successful operation, although positive assurance is given that the process used by the company is "the solution of the peat fuel industry," and "is not unlike, in a general way, the operation now carried on in Europe."

A Peculiar Drying Problem.—It has recently come to the notice of the writer that one of the large manufacturers of drying machinery has had an inquiry for a mechanical drier with which it is proposed to dry peat from 80 per cent to 40 per cent. moisture, after which the material is to be spread and dried to an air-dry-condition. The avowed object of this peculiar plan is to reduce the bulk of peat, which is then to be air-dried! This astonishing plan is evidently made by some one who has no need to count the cost very closely, as a very brief computation would show that it is vastly cheaper to handle the water by mechanical devices and evaporate it by the heat of the sun than it is to get rid of it by artificial drying. It is a most remarkable thing, however, that no theoretical considerations can be presented to people who are without practical experience in handling peat, which will divert them from the attempt

to do the impossible, after they have once become inoculated with the idea of drying peat by artificial heat. Facts, however, are stubborn things to contend with, and the facts before us, that it takes about 1,100 B. T. U. to convert a pound of water from average air temperature into steam, while a pound of coal of average quality yields under the best conditions only about 13,000 B. T. U., make it difficult to see how the proposition mentioned can be a commercial success, unless the product is to be sold at higher prices than peat products are generally supposed to bring.

The Possibilities of Peat.—Since the peat bogs form one of the few remaining unexploited natural resources of the country, and therefore constitute an unknown quantity, they continue to attract the attention of the newspaper writers and several interesting and conservative articles have appeared in leading daily and Sunday papers recently. The most prominent of these came out in the New York Herald of Sunday, June 26, 1910. This article, entitled "Vast Wealth to Be Taken from American Peat Bogs," was illustrated by a considerable number of half-tones of bogs and peat machinery; the article was interesting and up-to-date and included a sketch of this Society. In addition to this article, two half-column "stories" have been received from leading Pennsylvania dailies, one from the heart of the coal fields.

Fertilizer Experiments with Peat, begun three years ago at the Massachusetts Agricultural Experiment Station by Professor H. D. Haskins, whose paper appears in this number, are being continued this year, both with pot and with field cultures. Such experiments, to be of value, have to be carried on patiently for years, with great care from year to year, and with many kinds of plants. The lines of experimenting can be varied in many ways and many of these are of equal importance with the studies already begun. The object of the investigation, as is made clear in the report in this number, is to determine the fertilizing value of the kinds of peat used, and especially the availability of its combined nitrogen for growing plants. Such investigations have high scientific value, and are of great practical benefit to the farmers for whose use they are primarily made.

Alex. Dobson, of Beaverton, Ont., than whom there is certainly no one in America who has had more experience as a maker of peat fuel, writes the Secretary that his plant at Beaverton is running every day and he extends a cordial invitation to the members of the Society and others interested, attending the meeting at Ottawa, to go to Beaverton and see his plant at work. Mr. Dobson personally invented and developed the eequipment he uses, and all operations are carried on by electrical power, the only known peat fuel factory where this is

true. As is well known, the plant is a briquetting plant and the machinery for digging, spreading and gathering the peat is well worth going to see. As it is probable that invitations to visit at least two other peat plants in operation will be given those who attend the meeting at Ottawa, every one who can so arrange it should go prepared to accept and see all that can be seen, for by seeing only can most of us be convinced. "Things **seen** are mightier than things **heard**."

Conservation.—If "Conservation," about which we hear so much in these days, is the better and more intelligent use of our natural resources, to prevent their waste, then the recent move of the U. S. Steel Corporation to equip its great coking plants with by-products recovery ovens, is conservation of an admirable type. The cost of the changes that are being made is reported to be at least four millions of dollars, but the new plants will save the gas that is driven off from the coal during the coking, and much of the other products of distillation as a market can be found for. Among the important by-products to be obtained will be the ammonia formed from the nitrogen compounds in the coal, which is extensively used as the highest-priced constituent of artificial fertilizers, as well as for artificial refrigeration.

In the methods of coking coal now generally in use, all of the valuable volatile compounds of the coal are driven off into the air and absolutely wasted. The new method saves this waste, some of which will be converted into power and heat, and in this way, and by so much, will help conserve the fuel supply stored up in our coal fields.

North Carolina Peat.—This State may have a peat experiment station in the near future, if plans now in process of formation develop as those interested hope. The plan is to have a small, well-equipped testing station, for experimental and demonstration work. There are many parts of the state where other fuels are costly, where peat deposits are known to exist, and if the State or some organization of citizens would establish a small plant for educational purposes, the value of the peat could easily be shown. If one state could do this, others similarly situated would soon follow its example.

The Peat Manufacturing Company, Bangor, Me., has been at work since early in May, at its bog at East Orrington. Mr. Fred T. Dow, president and engineer of the company, has been improving the original machinery developed by him and increasing its capacity, and those interested in the company are well pleased with the results. At last accounts, plans were being made to dry and bale the moss and light moss peat from the top of the bog for florists' use and stable litter, for which purposes the material is usually well adapted, being almost wholly sphagnous in its origin.

FUEL USED IN STEAM AND GAS PLANTS.

Prof. R. H. Fernald gives in Bulletin 416 of the U. S. Geological Survey, a table showing the ratios of the fuel used in the gas and steam plants on which he made tests for the Geological Survey. The table is given below:

Ratios of Fuel Used in Steam and Gas Plants.

Average ratio, coal as fired per brake horsepower-hour under boiler to coal as fired per brake horsepower-hour in producer	2.7
Maximum ratio, coal as fired per brake horsepower-hour under boiler to coal as fired per brake horsepower-hour in producer	3.7
Minimum ratio, coal as fired per brake horsepower-hour under boiler to coal as fired per brake horsepower-hour in producer	1.8
Average ratio, lignite and subbituminous coal as fired per brake horsepower-hour under boiler to lignite as fired per brake horsepower-hour in producer	2.7
Maximum ratio, lignite and subbituminous coal as fired per brake horsepower-hour under boiler to lignite as fired per brake horsepower-hour in producer	2.9
Minimum ratio, lignite and subbituminous coal as fired per brake horsepower-hour under boiler to lignite as fired per brake horsepower-hour in producer	2.2
Average ratio, peat as fired per brake horsepowe-hour under boiler to peat as fired per brake horsepower-hour in producer	2.3

The steam plant consisted of 250-H.P. single-cylinder non-condensing Corliss engine, belted to a Bullock direct-current dynamo, and supplied with steam from two Heine boilers. The gas plant consisted of a 250-H.P. Taylor pressure producer, and a 19 × 22-in. Westinghouse vertical 3-cylinder, single-acting engine, belted to a Westinghouse direct-current dynamo.

BUSINESS OPPORTUNITIES.

Machinery.—Monthly Consular Report for May, No. 356, of the Bureau of Manufactures, U. S. Dept. of Commerce and Labor, states that a number of peat fuel manufacturers in Russia would like the names of American makers of peat machinery, with a view to acting as their representatives in that country. The names of these firms can be obtained by applying to the Bureau of Manufactures, Washington, D. C.

Peat Fertilizer Filler.—The Peat Engineering Company, Toledo, O., during June, had an enquiry from an eastern firm for 10,000 to 12,000 tons of peat fertilizer filler for this year. The enquirer states that probably twice this amount will be used within two years.

Peat Moss.—A large eastern manufacturing company desires clean peat moss, put up in bales, for use in its shipping department; large quantities are wanted. Anyone who has a bog from which such material can be obtained, and is willing to put it on the market, should send a sample of two to three pounds to the Managing Editor of this Journal, 209 St. Clair Building, Toledo, Ohio, and learn more about the proposition.

Literature.—The Engineering and Mining Journal, Vol. 89, No. 26, June 25, 1910, pp. 1334-1335, contains a brief but excellent account of the peat fuel plant of the Canada Department of Mines, and the operations of both this and the gas producer plant at Ottawa.

Peat Patents. (1). The manufacture of briquets from porous and hygroscopic fuels such as peat. T. Franke, French Patent 409,589, Nov. 25, 1909. The peat is freed from incombustible matter and, while still wet, is mixed with a readily combustible binding agent and formed into briquets. In this way the briquets retain the porous character of the peat, after the water has evaporated and burn more efficiently owing to the presence of oxygen and moisture in the pores.

(2) The manufacture of gas from peat. The Peat Gas and Coal Company, Montreal Canada. French Patent 409,263, Oct. 28, 1909; also English Patent 23,760, Oct. 16, 1909. Wet peat is macerated to destroy its porosity, and during the process is sprinkled with petroleum or other hydrocarbon. The resulting mass is then heated in a retort until converted into coke. Air is admitted to the retort during coking, and the heated air, mixed with gases from the retort, is carburetted by passing it through tar obtained from the peat. The gas is then cooled and the by-products condensed.

(3) Manufacture of plastic objects from peat, peat moss, and similar materials. T. Franke, French Patent 409,590, Nov. 25, 1909. Peat, peat moss, sawdust or other similar materials are dried in the air disintegrated, sifted and placed in water until "just saturated." A binding material is then added; if the materials are properly moistened this agglutinant does not penetrate the particles, but merely holds them together during the later drying process. By this method shoe soles and similar articles are produced and may be strengthened by incorporating layers of gauze in the mass.

(4) Drying apparatus for peat and the like. C. A. Matheson, Assigner to G. B. Farmer, Perth, Ont., Canada. U. S. Patent 957,232. May 10, 1910. The peat is caused to pass over the stepped bottom of a removable pan, arranged within a suspended casing, to which a reciprocating motion can be given. The pan is heated by suitable means and by a layer of heat-insulating material is interposed between the pan and the casing.

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24. Augus J. Cameron, 143 E. 7th St., care Liberty Hotel, St. Paul, Minn.
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55. L. C. Erbes, 1479 W. Minnehaha St., St. Paul, Minn.

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57. F. M. Frost, 10 Milk St., Room 636, Boston, Mass.
58. Herbert Garnett, 209 St. Clair Bldg., Toledo, Ohio.

General Electric Company, Schenectady, N. Y.

59. T. H. Gilmour, 413 McIntyre Blk., Winnepeg, Man., Can.
60. W. F. Goodrich, 636 Old South Bldg., Boston, Mass.
61. H. C. Gray, Greenwich, N. Y.
62. Dr. Eugene Haanel, Ottawa, Ont., President.
63. Everett H. Hadley, 141 Milk St., Room 620, Boston, Mass.
64. John J. Hallock, East Stroudsburg, Pa.
65. J. G. Hanby, 53 Buckman Bldg., Jacksonville, Fla.

66. Philip Heseltine, 60 Lafayette Bldg., Suite 705, Detroit, Mich.
67. R. B. Higbee, care The Willard Hotel, St. Paul, Minn.
68. John N. Hoff, 11 Broadway, Room 1564, New York, N. Y.
69. John W. Hornsey, 25 Broad St., New York, N. Y.
70. Allen Hubbard, 534 Albany Bldg., Boston, Mass.
71. Gust. A. Johansson, Box 103, Morris Plains, N. J.
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73. W. J. Jones, State Chemist, Perdue Exp. Station, Lafayette, Ind.
74. Jacob Keller, North Judson, Ind.
75. Alfred Kimber, P. O. Box 375, New York City.
76. P. Kirkegaard, D. M. & Reduction Co., Deloro, Ont., Can.
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89. Paul McLoud, Edgewater, N. J.
90. Dr. J. McWilliam, 402 Dundee St., London, Ont., Canada.
91. Maryland Geological Survey, Baltimore, Md.
92. C. A. Matheson, Perth, Ont., Canada.
93. George Matthews, Riga., Mich.
94. T. Arthur Mighill, 15 Exchange Place, Boston, Mass.
95. Carroll Miller, 20 Market Square, Providence, R. I.
96. Arthur C. Mills, Apartado 123 Bis, care U. S. & Mex. Trust Co., Mexico City, Mexico.
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99. O. E. Moulton, 704 Central Ave., Dover, N. H.
100. A. Murray, Wadena, Minn.
101. F. H. Nagel, 671 34th St., Milwaukee, Wis.
102. North Carolina Dept. of Agriculture, Raleigh, N. C.
103. Prof. C. L. Norton, Room 4, Walker Bldg., Mass. Inst. of Tech., Boston, Mass.
104. J. D. Oligny, 37a St. Augustin St., Montreal, Que., Can.
105. Pacific Utilities Corporation, 712 Delta Bldg., Los Angeles, Calif.

106. Ira Parker, 19 Kilsyth Road, Brookline, Mass.
107. Geo. B. Pelton, 707 Maryland Trust Bldg., Baltimore, Md.
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119. Walter H. Sawyer, Lewiston, Me.
120. Robert Schorr, Postal Telegraph Bldg., San Francisco, Cal.
121. J. C. Schumaker, 141 Milk St., Room 1120, Boston, Mass.
122. Willard Secor, Forest City, Iowa.
123. H. E. Smith & Co., Duluth, Minn.
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144. F. A. Zimmermann, 367 1st St., Brooklyn, N. Y.
145. Dr. Otto K. Zwingenberger, 106 Fulton St., New York City.

TABLE OF CONTENTS.

Frontispiece.
83—Biographical Sketch of Dr. Eugene Haanel.
87—Roster of the Fourth Annual Meeting, American Peat Society.
89—Program of the Meetings.
91—Address of Welcome, Controller Hinchey, Ottawa.
94—Reports from Vice-Presidents of Sections.
99—Propositions for the Welfare of the Society.
103—Peat Work in Canada, Mr. A. Anrep, Jr.
104—Excursion to Government Peat Fuel Plant at Alfred.
105—Address by Hon. Clifton Sifton, Chairman Canadian Conservation Commission.
111—President's Address: Exploitation of Our Peat Bogs for the Production of Fuel for Domestic Purposes, Dr. Eugene Haanel.
118—Peat Power Generation, Dr. T. Arthur Mighill.
131—Work of the Peat Engineering Co., Francis J. Bulask.
139—Report of Finance Committee.
141—Future of the Journal of the Society.
144—Review of the Peat Industry in Canada, Alexander Dobson.
151—A New Portable Peat Machine, Ernest V. Moore.
159—Banquet at Hotel Victoria.
159—Address of Toastmaster, J. R. Reid, Pres. Ottawa Board of Trade.
160—Response to Toast, Col. Foster, U. S. Consul.
163—Response to Toast, Prof. C. A. Davis.
167—Response to Toast, Robert Ranson, Vice-Pres. Southern States Section.
167—Response to Toast, Hon. Sidney Fisher, Minister of Agriculture of Canada.
171—Response to Toast, Dr. J. McWilliam, Vice-Pres. Canada Section.

TABLE OF CONTENTS—Continued.

173—Peat as a Fertilizer, and Some Methods of Drying and Preparing It, Robert Ranson.
181—Discussion.
185—Drying of Peat, Dr. J. McWilliam.
186—Progress of Peat Briquetting, O. E. Moulton.
192—Problems in Peat Filler Production, J. N. Hoff.
195—A New Patented Drier, C. E. Mark.
201—Resolutions of Thanks and Appreciation.
203—Discussion of Portable Peat Machines.
209—The Akerlund Gas Producer, C. P. Wood.
212—Peat Fuel by Frank's Process, Frank Frank.
218—The Future of the Peat Industry in America, Wm. Eichoff, M. E.
224—Col. J. J. Astor's Vibratory Disintegrator.
226—The Importance of Peat for the Manufacture of Nitrogenous Fertilizers, Robert Schorr.
232—New Process for Preparing Peat as Fuel.
233—Canada's Experimental Peat Plants, A. R. Maujer.
238—Peat Machinery and Production of Peat, J. H. Van Glahn.
240—Some Florida Peat Plants, Robert Ranson.
242—Peat in Russia.
244—Continuous Vacuum Filters as Dewaterers, Robert Schorr.
247—Editorials.
249—Editorial Notes.

DR. EUGENE HAANEL,
President of the American Peat Society,

Journal of the
American Peat Society

VOL. III JANUARY, 1911 Nos. 3 and 4

DR. EUGENE HAANEL,

President of the American Peat Society.

It is not often, in the march of events, that one man stands out as the leader in three great industrial movements of the times in which he lives. But this can be truly said of the man of science who, for a second term, sits in the chair of the American Peat Society—Dr. Eugene Haanel. In the industrial annals of Canada, the name of the present Director of the Mines Branch of the Department of Mines, Ottawa, will ever be associated with (1) the successful smelting—without coal or coke—of the highly sulphurous, titaniferous, refractory iron ores of Canada, by the electro-thermic process; (2) with the solution of the problem of economically utilizing the extensive peat bogs of the country, by the practical manufacture of a cheap, domestic, peat fuel, as a substitute for coal; and (3) by taking the initiaitve in the movement for the legislative regulation of the importation, manufacture and use of explosives, thus preventing the deplorable accidents and loss of life which are, today, of such constant occurrence.

Electric Smelting.

Thenard's dictum, that "the progress of a country may be measured by its advancement in the manufacture of iron and steel," has been verified by the marvelous material progress of Great Britain, the United States, and Germany, in recent years, largely due to this cause. In Canada, however, progress in iron and steel industry has been comparatively slow: (1) because the iron ores of the Dominion are, generally, of highly sulphurous content, and refractory nature, hence cannot be smelted economically in the blast furnace; and (2) because coal, in the middle Provinces, is conspicuous by its absence. Dr. Haanel set before himself the task of overcoming these seemingly insurmountable difficulties.

His first triumph, March, 1906, was graphically told by "The Canadian Engineer":

"At noon-day, Monday, March 12, 1906, we witnessed a remarkable scene at the Canadian Club of Toronto. Two hundred keen business men sat spellbound, listening to a story of scientific achievement and trade possibilities as wonderful as the vision of glory and wealth told by Raleigh and Drake on their first return from the Spanish Main. The orator of the day was a man of striking personality; above medium height, grey hair brushed back, body as erect as a grenadier, face bearing marks of strain, but with an expression like a summer's day; for, with a slight Teutonic accent, he spoke with conscious power, "as one having authority." By way of exordium, the influence of iron and steel in making for progress and civilization was told with masterly skill, followed by a panoramic word-view of the immense magnetic iron ore resources of Canada, hitherto incapable of being smelted in the blast furnace, on account of their highly refractory nature. Then was narrated the fact that upon his initiative the Dominion Government sent a Commission across the Atlantic to Sweden and France to investigate the latest processes of electric smelting. Based upon the Commission's report, he (the speaker) submitted a memorandum to the Minister of the Interior (Hon. Frank Oliver), suggesting electric smelting experiments on a comparatively large scale. At this stage, a glance at the faces of the audience as they listened with breathless interest, was a sight never to be forgotten. The silence was profound; for, with the art that conceals art, the speaker led his auditors step by step to Dr. Heroult's electric furnace plant at Sault Ste. Marie, and then, in imagination, throwing open wide the doors, disclosed fifty-five tons of pig iron piled in serried rows, successfully made from titaniferous nickel-ferro-pyrrhotite and sulphurous magnetic ores, at an expenditure of electrical energy, electrode and charcoal fuel consumption, simply startling, and almost ludricously low in the matter of cost. The speaker concluded with these pregnant words:

"'The Government has furnished you with facts on which to base a sound judgment as to the feasibility of commercially engaging in the manufacture of pig iron by the electric process; with that its duty to the nation is done, it remains with you business men to apply, perfect, and profit.'

"A scene of enthusiasm followed, for every man present realized what this triumph in metallurgical science meant to his country."

Not only have the experiments at Sault Ste. Marie been confirmed; but electric smelting on a commercial scale is now an assured success.[1]

Peat Fuel.

Having demonstrated the feasibility of economically smelting refractory iron ores by electricity, Dr. Haanel then turned his attention to the problem of providing a cheap domestic fuel for the Middle Provinces: Quebec, Ontario, and Manitoba, where there is no coal, but very extensive peat bogs. Before commencing experimentation, however, he determined to collect data on existing methods of manufacturing peat fuel; and to this end, commis-

1. Recent Advances in the Construction of Electrical Furnaces for the Production of Pig Iron, Steel, and Zinc, by Eugene Haanel, Ph. D. Published by the Department of Mines, Ottawa, 1910.

sioned an expert on his staff to visit the various European countries where peat fuel was in extensive use, viz: Sweden, Norway, Germany, Russia, Denmark, etc. This resulted in the publication of an elaborately illustrated report by the Dominion Government, entitled, "Peat and Lignite: Their Manufacture and Uses in Europe" —1908. So great was the demand for this official publication, and so manifest the interest evoked on the subject—since wood fuel was becoming scarcer and dearer every year, and coal almost prohibitory for the poor: $7.50 per ton in Ottawa, and $10.50 in Winnipeg—that upon Dr. Haanel's recommendation, 300 acres of a good peat bog were acquired by the Government, and a modern, Swedish plant installed, with a view to demonstrating that peat fuel could be manufactured economically, and sold cheaply, as a substitute for coal. Canada's enterprise soon attained international celebrity; and the American Peat Society recognizing the pioneer work done by Dr. Haanel, elected him president for 1909-10, and decided to hold its fourth annual meeting in Ottawa, July, 1910. The convention held in Canada's beautiful capital was a complete success, both technically and socially; and Dr. Haanel's contribution thereto may be gleaned from the following extracts from the official report of the proceedings:

"It is characteristic of your President that when he takes up anything he does it with extreme thoroughness and care, and I doubt not that his characteristic will be in evidence in the conduct of your proceedings here."—(Address of welcome, Hon. Clifford Sifton, M. P., Chairman of Canadian Conservation Commission, July 25, 1910.)

"I know of no one who has done more by careful experimentation to secure scientific utilization of natural resources than our friend Dr. Haanel." (Applause.)—(Colonel John G. Foster, American Consul, at banquet, July 26, 1910.)

"Surely no Society ever had a president who did more for it in one year than Dr. Haanel, our honoured president."—(Professor Chas. A. Davis, Editor, American Peat Society's Journal.)

"I am heartily in accord with the remarks made by one of Canada's statesmen—Hon. Mr. Sifton (applause) when I say that we are very appreciative of the honor conferred on Dr. Haanel by you in re-electing him President of your Society."

"The Government of Canada, ever mindful of the industries and resources of the country, and believing we have in this country vast beds of peat which ought to be, and can be, utilized for the benefit of our people and the world, has given a free hand to its scientific men to see what can be done by the hand of science, and the man who wields it. **Dr. Haanel is a scientific man who has placed his knowledge, and his skill, and his industry and intelligence at the service of the people of this country.**"—(Hon. Sydney Fisher, Minister of Agriculture, at banquet, July 26, 1910.)

That the subject of our biographical sketch has succeeded in practically solving the problem of cheap peat fuel, is evidenced by the following resolution adopted unanimously by the American Peat Society, July 27, 1910:

"Resolved, that the American Peat Society hereby expresses its

thanks to the Hon. Wm. Templeman, Minister of Mines, for his cordial welcoming telegram, and for the opportunity of visiting the most interesting and satisfactory demonstration peat-fuel plant at Alfred, and the peat gas producer and power plant in Ottawa.

"That congratulations are extended to the Minister and to the Director and experts in charge of these plants for the success that has crowned their efforts, and the very important demonstration which they have made of the practicability of making peat-fuel in quantities, and of using it for the production of power."

At the present time—while still acting as an outlook committee on electric smelting and peat fuel manufacture—Dr. Haanel is conducting a thorough investigation into the unscientific, unregulated, and reckless use of explosives in mines, etc.; with a view to establishing testing stations, and enacting stringent laws to prevent accidents and loss of life. When this important work is completed, he will not only have done things which have made for material progress and prosperity, but rendered priceless service in the cause of humanity.

It is one of the distinguishing marks of genius, that it leaves the impress of its forceful personality upon whatever it touches. This is strikingly exemplified in the case of Dr. Haanel, for the three progressive movements associated with his name have all been evolved as part of his daily work as Director of the Mines Branch of the Dominion Department of Mines, Ottawa. This achievement has not been due to a fortuitous concourse of circumstances, but to a high sense of the duty of public service, a keen insight into the signs and needs of the times, and a wise perception of the psychological moment for carrying out much needed industrial reforms; all backed by a well trained intellect, undaunted will, and wide, varied experience of men and things.

Biographical Notes.

Dr. Eugene (Emil Felix Richard) Haanel was born at Breslau, Germany, May 24, 1841. Graduated from Gymnasium, Breslau, 1858. Received A. M., Athens, Ohio, U. S. A., 1872; and Ph. D., Breslau, 1873. Endowed with the gift of teaching, he subsequently occupied the following chairs: Professor of Science, Adrian, 1886; Professor of Natural Science, Albion, 1868-72; Professor of Physics and Mineralogy, and Director of Faraday Hall. This institution, erected by Dr. Haanel, was the first Science Hall in Canada. He was also Dean of the Faculty of Science, Victoria University, Cobourg, Ont. The last period of his academic career was as Professor of Physics, Syracuse University, U. S. A., 1889-1901, where he erected the "Esther Baker Steele Hall of Physics." Then came the call, in 1909, to fill the important position of Superintendent—subsequently enlarged to Director—of Mines of the Dominion Government, a service which has just culminated in the signal triumphs narrated above.

Dr. Haanel's place in science for original work will be associated with (1) Hydriodic acid as a blow-pipe reagent; (2) Gypsum tablets in blow-pipe analysis: (3) Hydro-bromic acid and tetrachloride of tin in blow-pipe reagents.

In technical literature he will be remembered as the author of

"Location and Examination of Magnetic Ore Deposits by Magnetometric Measurements."

He is a member of the following learned societies: Physical Society, Canadian Mining Institute, Fellow Royal Society of Canada (charter member), Faraday Society, Vice-President Institute of American Chemical Engineers, and President American Peat Society.

Such, briefly told, is the public career of the man of mark, whom the American Peat Society has delighted to honor, by re-electing him to the presidential chair for the year 1910-1911.

FOURTH ANNUAL MEETING OF THE AMERICAN PEAT SOCIETY.

Ottawa, Canada, July 25th, 26th and 27th, 1910.

The most sanguine anticipations for the success of the Fourth Annual Meeting of the American Peat Society, held in Ottawa, Canada, July 25, 26 and 27, were more than realized in every respect, and at its close, all who attended felt that much good had been accomplished by exchange of ideas and in the dissemination of knowledge pertaining to the utilization of peat in various ways. The meeting was held in the lecture hall of the Normal School, a beautiful structure in the central portion of the city and peculiarly well adapted for convention purposes.

On the Registration Roll were the following:

Joseph Bradley, Three Rivers, P. Q.
Bernard Mullin, Ottawa.
Geo. C. Holland, Ottawa.
R. W. Ellis, Ottawa.
Archibald Blue, Ottawa.
L. B. Lincoln, Farnham, P. Q.
Ernest V. Moore, Peterborough, Ont.
Gustav E. Carlson, Farnham, P. Q.
Controller E. H. Hinchey, Ottawa.
Mrs. Hinchey, Ottawa.
J. J. Hallock, Syracuse, N. Y.
Richard Hallock, Stroudsberg, Pa.
A. Zimmerman, New York.
A. Anrep, Ottawa.
Dr. Eugene Haanel, Ottawa.
Chas. Warren Davis, Augusta, Ga.
Felix A. Vogel, New York.
Mrs. Vogel, New York.
John E. Askwith, Ottawa.
McLeod Stewart, Ottawa.
Carl Kleinstueck, Kalamazoo, Mich.
Miss Kleinstueck, Kalamazoo, Mich.
Dr. J. McWilliam, London, Ont.

Prof. Chas. A. Davis, Washington, D. C.
Louis H. Owen, Chicago.
Mrs. Louis H. Owen, Chicago.
F. P. Megan, Toronto.
Frank Frank, Guelph, Ont.
Dr. T. Arthur Mighill, Boston.
Mrs. Mighill, Boston.
M. C. Franklin, Brockville, Ont.
Francis J. Bulask, Toledo, Ohio.
J. M. Craig, New York.
Julius Bordollo, New York.
Clarence L. Dicker, Aurora, Ont.
Henrique A. Kingston, Rio Janeiro, Brazil.
C. E. Mark, Chicago.
Mrs. C. E. Mark, Chicago.
T. C. Denis, Supt. Mines, P. Q., Quebec.
E. D. Ingall, Ottawa.
W. J. Hay, Oshkosh, Wis.
Mrs. Hay, Oshkosh, Wis.
W. J. Hay, Jr., Oshkosh, Wis.
D. J. Driscoll, Ottawa.
S. Groves, Ottawa.
Mrs. S. Groves, Ottawa.
J. J. Bell, Ottawa.
F. G. Wait, Ottawa.
C. A. Matheson, Perth, Ont.
J. A. Robert, Mines Branch, Ottawa.
W. H. Roughsedge, Ottawa.
A. Roughsedge, Ottawa.
H. O. Chute, New York.
W. H. Lowrie, Russell, Ont.
E. A. Scott, "Iron Age," New York.
W. J. Faubairn, Ottawa.
Hon. Clifford Sifton, Chairman Dominion Conservation Commission, Ottawa.
T. D. Withrow, Ottawa.
J. D. C. Adamson, Ottawa.
Miss M. Millar, Princeton, N. Y.
E. Stansfield, Ottawa.
Godfrey M. Tait, New York.
H. M. Sinclair, Toronto.
E. Kidd, M. P., North Gower, Ont.
Robert Ranson, St. Augustine, Florida.
C. A. Meissner, New York.
J. A. Gray, New York.
W. A. Forbes, New York.
J. R. Reid, Ex- Pres. Board of Trade, Ottawa.

Peter Whelen, Pres. Board of Trade, Ottawa.
Mrs. Whelen, Ottawa.
J. H. Gray, New York.
William S. Milne, Boston.
C. F. Kittrege, Boston.
F. M. Frost, Boston.
H. S. Milne, Hamilton, Ont.
C. W. McDonald, Alexandria, Ont.
Frank T. Shutt, Dominion Chemist, Ottawa.
L. C. Erbes, St. Paul, Minn.
James Graham, Ottawa.
R. A. Craig, North Gower, Ont.
D. Ramson, Ottawa.
Arthur J. Forward, Ottawa.

The following program had been announced by the Secretary:

PROGRAM.

MONDAY, JULY 25th, 1910.

Morning Session, 9 o'clock.

1. Opening Remarks by the President.....*Dr. Eugene Haanel*
2. Report of Officers.
3. Committees' Reports.
4. Propositions for the Welfare of the Society.
5. Nomination of Officers.
6. A History of the Peat Industry of Canada.....
   .....*Alexander Dobson, Beaverton, Ont.*
7. The Government Peat Plant at Alfred.....
   .....*A. Anrep, Jr., of Department of Mines*

Afternoon.

8. Excursion to Government Peat Plant at Alfred.
   According to weather conditions this may be changed to one of the following days.

Night Session, 7:30 o'clock.

9. Address by the President.....*Dr. Eugene Haanel*
10. Draining of North Carolina Swamp Lands, and Amount of Peat Found Therein.....
    .....*Dr. Joseph Hyde Pratt, State Geologist, N. C.*
11. Peat Power Generation.....*Dr. T. Arthur Mighill, Boston*
12. Work of the Peat Engineering Company.....
    ..... *Francis J. Bulask, Toledo*
13. A New Portable Peat Machine.....
    .....*Ernest V. Moore, Peterborough, Ont.*
14. Description of Colonel John Jacob Astor's Vibratory Disintegrator for Peat Gas Producers.

TUESDAY, JULY 26th, 1910.

Morning Session, 9 o'clock.

15. Election of Officers.
16. (*a*) The Journal of the American Peat Society.
    (*b*) Peat Investigation of the U. S. Geological Survey.
    (*c*) The United States Bureau of Mines.
    Prof. Charles A. Davis, Peat Expert, U. S. Bureau of Mines
17. Drying Peat.....*Dr. J. McWilliam, London, Ont.*
18. A Well Equippel Peat Fuel Plant, and How to Operate It.....*Philip Heseltine, Detroit*

Afternoon.

19. Visit to Government Fuel Testing Plant in Ottawa, and Automobile Tour about the City.

Evening.

20. Banquet at Hotel Victoria, Aylmer.

WEDNESDAY, JULY 27th, 1910.

Morning Session, 9 o'clock.

21. Prospect of the Peat Industry in the Northwest.....
    .....*Max Toltz, St. Paul*
22. The Development of Gas Producers for Peat and Lignite
    .....*Prof. R. H. Fernald, Producer Gas Expert, U. S. Bureau of Mines*
23. Progress of Peat Briquetting...*O. E. Moulton, Dover, N. H.*
24. The Future of the American Peat Industry.....
    .....*William Eichhoff, Erie, Pa.*

Afternoon Session, 2 o'clock.

25. Some Problems of the Peat Filler Manufacturer.:....
    .....*J. N. Hoff, New York*
26. Peat as a Fertilizer and Methods of Drying Same....
    .....*Robert Ranson, St. Augustine, Fla.*
27. The Latest Achievements of the Aukerland Gas Producer
    .....*Gibbs Gas Engine Co., Atlanta, Ga.*
28. Peat Litter.....*J. Bordollo, New York*

OPENING SESSION.

Monday Morning, July 25th, 1910.

DR. EUGENE HAANEL, President: I will open this the first session of the American Peat Society's fourth annual meeting by reading a telegram from Hon. Mr. Templeman, Minister of Mines, which is dated Victoria, B. C., July 22nd, and is as follows:

"Dr. E. Haanel, Director Mines Branch, Ottawa: Will you please extend to the American Peat Society a welcome on my behalf to the city of Ottawa and express my regret that absence in the West prevents my attendance at the fourth annual meeting? I am convinced there will be a successful meeting and that great benefit will result therefrom. The profitable utilization of the vast deposits of peat in Canada and the United States, a valuable resource of both countries thus far unused and worthless, will be a great achievement and worthy of the best efforts of the scientific and practical members of the Peat Society. The Canadian Department of Mines will assist in the work of the Society in every possible way. W. Templeman, Minister of Mines."

I regret exceedingly to have to state that on account of the illness of His Worship the Mayor, he will not be able to address you this morning. Controller Hinchey has been delegated to represent him and to give you an address of welcome. I have now great pleasure in introducing Controller Hinchey. (Applause.)

Address of Welcome, Controller Hinchey.

CONTROLLER HINCHEY: Mr. President and members of the American Peat Society: I can assure you that I regret exceedingly the absence of His Worship Mayor Hopewell this morning, as that gentleman has been confined to bed with illness for a week past. I wish to repeat my regret for more reasons than one, because, had His Worship been present, he would have been able to address you in a far more interesting manner than I, but I can assure you that while our Chief Magistrate might address you in more eloquent terms than I am capable of doing, that he could not welcome you to our city more sincerely or more heartily than I wish to do now.

The city of Ottawa which you have seen fit to honor by your presence this morning is made up of about one hundred thousand souls. Here you find a happy and contented people, living under laws and conditions which they themselves have created, and are enjoying all the blessings and privileges which come with representative government.

The idea and the effort of the people of great centers at present appear to be directed towards acquiring and controlling all public utilities in the great cities. In this direction we are not behind the times, as we have in Ottawa a municipally owned and

operated water supply—a municipal lighting department; we light all our own streets as well as many buildings in the city; we have an asphalt paving plant of our own and our City Engineer puts in a tender on all contracts, and, while not successful in many cases, still he does secure a fairly good proportion of the work. This regulates the prices and prevents exorbitant demands by combines, contractors or manufacturers, and as a recult the city gets its paving at a reasonable cost.

In addition to this we build our own sidewalks by day labor. We have an electric railway, the charter of which will expire in about thirteen years, and I feel warranted in saying at the expiration of that term the people in all probability will acquire that utility. While you strangers may readily be pardoned for lack of knowledge of these matters, which are after all only of local importance, I presume many of you have heard of the Georgian Bay and Ottawa Ship Canal. This canal I feel sure will be constructed in the very near future because the business of the country demands it. When this is done, it means we will have a water communication from the head of the Georgian Bay to the seaports. It will mean, in other words, that Ottawa, which is now a far inland city, will boast of all the advantages of an important seaport.

The object of your mission this morning is a most worthy one, as you have come here, I understand, to discuss and consider the advisability of promoting the peat industry in Canada as well as in the United States. That, indeed, is a most worthy cause, for as we all know the cost of fuel is becoming a most serious matter. The prices are necessarily increasing from time to time and it would be a blessing to the world at large if some means should be devised whereby we could get cheaper fuel. At one time in this country, our forests apepared to be almost inexhaustible, but not long since I was speaking to a lumberman who said that twenty-five years ago he gave orders to his men in the woods in this vicinity not to draw out any logs that had not a diameter of more than twelve or fifteen inches. You will readily see that this means the trunk of a tree had to be very large for the tree to be taken out. Today the thickest portion of the ordinary log drawn out hardly exceeds the minimum measurement of those taken in former days.

Apart from this waste, and there was a considerable waste in the forest, great areas of our fine forests have been hewn down to make way for the plough of the settler from this and other lands. On the other hand, the mines of America, those of the United States and Canada, are being bored and delved into day by day by hundreds and thousands of miners, and vast as the quantity of coal is, with the enormous demand made upon those mines, the time must eventually come, if not in this generation or the

next, in the near succeeding ones, when the supply of fuel will run short. For this reason if you can develop a commodity of fuel in the peat industry you will not only be conferring a benefit upon the people of the present day, but you will have the unbounded gratitude of the generations to come.

I do not propose taking up too much of your time, suffice to say I am delighted to welcome you to our city. We have a beautiful and up-to-date city; we have many paved streets, beautiful lawns, parks, a magnificent drive-way of which we all are proud, not to speak of the splendid structures which adorn this capital.

The fact that you American citiens came to our city on a mission of peace, as you are doing, is something to be encouraged, because the more we exchange such visits and the more the two peoples mingle one with the other, the better they will come to understand each other. An effort is now being made which I feel will meet with universal favor, to celebrate in 1912 the one hundredth anniversary of peace between the great American Republic and the people of this country. I understand that this movement has already obtained the sanction and approval of your distinguished and honored President, and I feel that when the time arrives, it will mark an important epoch in the world's history and serve as an object lesson to the world, that, while some nations can celebrate victories on the field of battle, a victory of peace between two great nations side by side, is of far more importance than any victory achieved by arms. (Applause.) While a war at any time between the British Empire and any other nation may be looked upon with alarm, while the shedding of blood, the suffering of the wounded and dying, not to speak of the deprivations of orphans and widows made, while, I say, that it is alarming to think of with any other nation, the thought of a war between any portion of the British Empire and the Great Republic of the United States, is too awful to contemplate and impels us to the hope that it will never occur. It is generally known that wherever the Union Jack, the emblem of the British Empire, or the Star Spangled Banner of the United States may be, whether they float from the flag pole of some far distant possession, or from the mast head of vessels on the high sea, it is generally recognized the world over that both emblems stand for liberty, justice and freedom, and as such are universally acknowledged.

I trust this first visit you have made to our city will be conducive of good results and that it may prove but the forerunner of many to follow. We hope you will be favorably impressed with the natural advantages of the city of Ottawa, with the beauty of its streets and buildings and with its industries. I say we trust you will be sufficiently impressed with what you see, so that you will be warranted on returning to your respective homes to

tell your friends and acquaintances that Ottawa, the capital city of the Dominion of Canada, is an up-to-date, progressive city, and one well worth visiting. I thank you for your kind attention and I wish you every success in the deliberation of the questions you are going to consider for the promotion of the peat industry. (Applause.)

THE PRESIDENT: I thank you, Controller Hinchey, on behalf of the members of the Society, for the very interesting address of welcome which you have delivered to them.

At the request of the President, Dr. McWilliam then took the chair.

READING OF CORRESPONDENCE.

MR. BORDOLLO, Secretary: We have received a letter from Mr. Hans Schreiber, Secretary of the Austrian Peat Society, as follows:

"The American Peat Society.

"Gentlemen:—Referring to my letter of recent date, I am sending you today a box weighing 125 pounds, with the following contents:

"1. To the American Peat Society a collection of types of peat and products and a number of my works which it would be best to give into the hands of the editor of your journal, except the folio of plates, which would better remain with the collection. (77 different kinds.)

"2. A collection for Mr. Julius Bordollo, a collection of books and peat products of practical nature, the contents of which I have enclosed. (24 different kinds.)

"3. A collection for Professor Davis of peat works and peat samples of scientific nature, the contents of which I have sent direct to him. (75 numbers.)

"4. A collection of books (Vorarlberger Moor) and the latest bog cultivation and peat utilization for general distribution.

"I would be very glad, in scientific as well as practical relations, to do anything to promote mutual benefit. I would be very glad to receive American peat samples and peat literature.

"Wishing your Society great prosperity, I am,

"Yours very truly,

"Hans. Schreiber.

"Staab, Austria, July 8th, 1910."

Upon motion a very hearty vote of thanks was passed to Mr. Schreiber for his consideration and kindness.

MR. LINCOLN: I consider myself the only member of the Austrian Peat Society in America, and I wish to state on behalf of the officers and members of that Society that they greatly appreciate the courtesies extended, and particularly on behalf of Mr. Schreiber I thank you.

MR. CARL G. KLEINSTUECK (Kalamazoo, Mich.): Mr. President and Friends: I have written to some of those interested in the peat business in my section of the world and have received the following answers. I might state before reading these that the Governor of Minnesota called a Conservation Congress at St. Paul in March. Everybody who was thought able to contribute some knowledge was invited to be present with exhibits, and I was invited to go there and tell the people of Minnesota what I knew, and I took my collection of peat samples along with me. Well, the interest shown in Minnesota in the peat business was certainly striking. I stood from 9 o'clock in the morning to nearly midnight, and for four days the interest never slackened. The questions asked showed that the people were wide awake to the proposition. The State Geologist said that one-fourth of the state of Minnesota was bogs or muskeag. Some bogs were eighteen miles long and how deep no one knew. One man said he went down fifteen to twenty feet and did not know how much deeper he would have to go to reach the bottom. Since I came back from St. Paul I have received several letters from men in all walks of life, principally from lawyers, strange as it may seem, inquiring as to the ins and outs of making peat. One of the letters I received was from H. E. Francisco, of Mason City, Iowa. It is dated July 13th, 1910, and reads:

"Dear Friend:

"Your card of the 10th instant received and note what you say about the meeting of the Peat Association. I am not now with the Peat Company here, but when I was with them we did well and put out a great quantity of peat and burned the pressed brick most entirely with it; of course, at the last we used some coal, after we got the temperature up to the right heat, but had we had larger capacity we would have burned peat entirely, I am confident, for it is a very excellent fuel.

"I understand they have been offered as high as $10 a ton for it recently and have been informed that they have shipped out quite a good deal of it.

"The peat proposition to me is one that will be one of the great factors in the future, for every day we hear of its new uses, etc."

Another, from Mr. P. A. Belangee, of the Peat Fuel Manufacturing Company of Minneapolis, Minn., reads:

"Dear Sir:

"I would say that there is nothing I would enjoy more than to be with you, but I find it will be mpossible. After thoroughly investigating the peat situation in all of its different forms we have decided that there is nothing to do but put in an air drying process. We expect to have our plant running in a short time now with this kind of a machine. We are also going to put in a fertilizer plant, which, we believe, will pay better than peat.

"Wishing you success and assuring you that I am glad to do anything to help the peat industry, and will have a report ready for you next year, I am,

"Yours truly, "P. A. Belangee."

Here is one from Harlan E. Leach, of the law firm of Leach & Reigard, Owatonna, Minn., dated July 14th, 1910:

"My Dear Mr. Kleinstueck:

"You ask about peat conditions in this county. They are about as follows:

"This county, consisting of twelve townships, is in the shape of a basin, with a watershed on all sides except in a few places. Around this watershed are large deposits of peat, amounting to several hundred acres in the county. On my farm of 520 acres in the southern part of the county there are from 100 to 150 acres of peat. I have sunk an auger in several places in this peat bed for 15 to 20 feet without finding bottom; I have no idea how much deeper the peat is. The peat seems to be of a very fair or good quality, and has been burned to quite a large extent by farmers living in the vicinity of these peat beds; they dig the peat, let it dry and then burn it in its natural condition. No steps have ever been taken in this county, I believe, to manufacture peat fuel or to do anything else with it except to burn it as above stated.

"We are located a very long ways from coal, but coal is the principal fuel here. In the early days wood was very plentiful and very cheap, but now it is very scarce and dear. Some of the peat in this county is close to railroads and some four or five miles away. We have no electric line here yet, but one is preparing to build now, but probably will not go near any peat deposits. Peat land here, which has not been drained, is held at a very low price, but that which has been drained and put into crops after having been pastured, produces enormously. I believe it will be only a short time before all these peat lands are drained and used for agricultural purposes. Drainage is easy.

"I very much would like to see some peat industry start in this county, and if you know of any who wish information with

a view of development in this line of industry, I should be very much pleased indeed to correspond with them. I have no time myself to manufacture peat products.

"Wishing you the greatest of success and pleasure at your annual convention and expressing my regret at not being able to attend, I am,

"Yours very truly,

"Harlan E. Leach."

Mr. Max Toltz, of St. Paul, Minn., writes under date of July 14th, 1910:

"My Dear Mr. Kleinstueck:

"I have taken up the matter of coke production from peat with the United States Steel Company, but cannot report any progress as yet.

"The people will be surprised at the great area of peat bogs in Minnesota. The bog I referred to up north of Duluth is, instead of 20 miles long, over 80 miles, with a width of 4 miles and a depth of probably 30 feet of good working material.

"People here are wide awake to the fact that peat will some day be a great factor of our fuel supply, and not a week goes by that I'm not consulted regarding its use.

"I even have under consideration one power plant in which peat gas-producers will be used.

"Our membership now numbers 23 and we intend to exhibit at our next State Fair the beginning of September, at which time the National Conservation Congress will meet here. We will also exhibit machinery, if we can get it, and at the same time hold a meeting to which the public in general will be invited. Our plans are not as yet perfected, due to the fact that the Fair Grounds Board has not acted promptly regarding space for our exhibit. As soon as they do and we know what space is allotted to us, we will then take proper action.

"I have corresponded with Mr. Julius Bordollo in regard to a Society meeting here at St. Paul for the year 1911, as in the meantime we will have increased our membership and be in better shape to take care of same."

(Letter to Mr. Bordollo.)

"St. Paul, July 1, 1910.

"Dear Sir:

"As you know, the National Conservation Congress will meet here at the beginning of September, when our State Fair will be going on. I want to arrange an exhibition of peat products

and machinery, if I can get the space at a low figure. Will you kindly let me know what machines especially should be exhibited, also give me the names of the different manufacturers so I can communicate with them. We will have a very large attendance at the fair grounds. We generally have between 30,000 and 40,000 per day, and besides we expect about 15,000 delegates to the Conservation Congress. At the same time we will have a meeting of the Minnesota section of the Peat Society and I expect, if everything is arranged properly, that some officers of the American Peat Society could be present."

It is remarkable how the subject interests professional men. Here is a letter from Mr. E. B. Evans, of Drake University, Des Moines, Iowa, Dean of the College of Law, dated July 13th, 1910. In it he says:

"I am not much further along with the peat proposition than when I was in Kalamazoo. I think it is a big thing to investigate. Several things are delaying activities with us. We are in hopes that the County Commissioners will order some county ditches which will enable us to get rid of a large part of the water with which our peat bog is saturated.

"I am also continuing to investigate the machinery proposition, which seems to be in its infancy in the United States. What is your opinion as to the best use of peat where the ash product is in the neighborhood of 30 per cent.?"

I would say if the peat has 30 per cent. ash, not to touch it.

MR. GEORGE HOLLAND: You say not to touch it, if it has 30 per cent. ash—would it not be valuable as a fertilizer?

PROF. CHAS. A. DAVIS: The ashes of peat generally have very little direct fertilizing value—not nearly comparable with wood ashes, but they have been recommended as an absorbent to mix with stable litter. The handling of ash takes much time, even with the best of coal, and it is heavy and dusty. When burning peat the ash is less than with coal, and light in weight, but with peat giving 30 per cent. ash one would have to take considerably more out of the ash box than with coal. There have been attempts to use peat with high ash percentage, but they have been abandoned.

A MEMBER: Hasn't it been used by gas companies?

PROF. DAVIS: As to the use of peat with 30 per cent. ash in making producer-gas I have had some experience. Some of us saw the peat from North Carolina that was machined by the U. S. Geological Survey at the Jamestown Exposition while we were there at our first meeting. That peat was dried; it was transported with other materials to Pittsburg and about a year

and a half after machining was run through a gas-producer and analyzed, and the average analysis showed over 29 per cent. ash and about 15 per cent. moisture, yet that material without deduction for ash and moisture gave a commercial horse power per hour for every 4 pounds fired; that is, each 4 pounds gave a horse power per hour at the switch-board. So peat with 30 per cent. ash if the ash does not clinker too much, can be used in a gas-producer with about that result, 4 pounds will give a horse-power per hour, if the right sort of a gas engine is used to consume the gas.

A MEMBER: Will not a 30 per cent. ash peat clinker all of the time?

PROF. DAVIS: It is possible by the use of steam in the gas-producer to keep the ash temperature below fusion point and thus prevent clinkering.

MR. KLEINSTUECK: I would like to ask about alkali in peat. In Minnesota there were samples which, when dry, looked gray like coal ashes and I was informed that alkali in the peat was the cause and that it did not interfere with the burning qualities of the peat.

PROF. DAVIS: Some samples called alkali peat recently sent me were about 50 per cent. peat and 50 per cent. mud—you could hardly call it peat. The "alkali" was simply limey material like marl.

MR. HOLLAND: Was there any considerable percentage of potash?

PROF. DAVIS: No, very small.

PROPOSITIONS FOR THE WELFARE OF THE SOCIETY.

THE SECRETARY: There are a great many people interested in peat all over the United States and Canada, who really never have been approached in proper form to join our Society. At present our membership is 152, but you will notice during the year only about 80 paying members. While all our work is voluntary, it would be advantageous to the Society if the Editor could be authorized to engage a stenographer to work a week each month to follow up those who would probably become members. If all enquirers were thus followed up, the membership should be a thousand within a year. It cannot be expected, however, that this can be done by members outside of regular business hours, and I propose that you appoint a committee on finances to take up this matter and report tomorrow morning.

PROF. DAVIS: It seems to me this matter of finances is important and I would move that a committee of three be appointed to report on some plan. I will suggest that since Mr. Bulask has had so much experience in handling the Journal that he be made a member of this committee.

This motion was carried and Mr. Bulask, Mr. Carl Kleinstueck and the Secretary were appointed such a committee.

Mr. Craig and Mr. Anrep were appointed Auditing Committee, and Prof. Davis, Messrs. Owen, Lincoln, Kleinstueck and Moore, Committee on Nominations.

THE CHAIRMAN: Are there any other suggestions for the welfare of the Society?

PROF. DAVIS: I move the appointment of a committee of three, on resolutions, to which also may be referred any matters pertaining to the welfare of the Society, changes in the by-laws and similar questions, the committee to act as a receiving and formulating body.

This motion was adopted and Prof. Davis, Mr. Vogel and Dr. Mighill were appointed as the committee.

MR. LINCOLN: I wish to say a few words in regard to the finances of our Society. I have four points to present, which I think will promote the welfare of the Society. First, to raise the dues. At present the only requirements are ability to sign your name and to pay $3. I would like to see a more rigid investigation of those wishing to join. Furthermore, I do not consider $3 a year sufficient support to a society doing so much good, or that would be able to do so much good for everyone of us. Is it not worth, say 50 cents a month? How much more good we could do if the dues were that! Let $3 be set aside for the Journal and the other $3 go towards a fund to enable our officers to fulfill their duties more satisfactorily to themselves and us, as it would provide them with the means of securing collections and information which it is well nigh impossible for them to get otherwise. This would be all for our instruction, and I understand there is no appropriation for that now.

This leads me to speak about our officers. While our President and Vice-Presidents receive no salary, there is one office that should be salaried, that of the Secretary, which is salaried in almost every organization. A man, however rich, cannot afford to give his time and ability to an organization that does not reward his services with a nominal salary at least. There are a great many letters that must be answered and other matters attended to, and therefore I recommend that a salary be attached to the office.

Now, as to the Journal. The Journal is the place where we come together mentally, and we should have an issue coming out

every month. As to the Managing Editor, we should not expect him to do all the work gratis, we ought to have an Editor under pay, and one who can give a great part of his time to editorial work. That would result in more good to us than a great many meetings of the Society.

Every one of us should do our best to increase the membership. We have a lodge in Chicago, and two years ago the President got after the members and made each pledge to bring in a new member. There were 5,000 members then and today there are 10,000. We can do that easily here. Every one of us has friends who will certainly spend $6 a year for the information to be obtained from this Society. We know that coal is going to be exhausted—in some parts it is $10 per ton even now—and if I went into that country spoken of by Mr. Kleinstueck, I think I could bring in 100 members, and I pledge myself today to bring 50 members at the next meeting. I have brought three today. (Applause.)

THE CHAIRMAN: I can testify to the value of the Journal to the Society. If ever we are to have a peat industry on a sound basis it will be necessary to engage in an educational campaign, and we could not do that better than by spreading this valuable Journal throughout the United States and Canada. We can make this and that suggestion with good results, but the question is, "How to get the money?" I sympathize thoroughly with the remarks made, that the Secretary-Treasurer should be paid, and well paid, because the duties of a Secretary are very onerous. The success of the Society depends upon him. It would not give me much difficulty to solve this question in Canada, but I am not familiar with what you do in the United States. If I were to bring this matter before the Government, they would assist with a vote. They would realize that it was so important that they would give the money to pay the Secretary and have the work carried on. I hope that if you get money by increasing the membership that we will place the laudable peat industry on a sound basis.

CHARLES W. DAVIS (Augusta, Ga.): Though one of your oldest members, I am just a layman in this business, and I was certainly surprised to know that I was getting that magnificent Journal four times a year and my membership for the sum of $3. I really think it would be very reasonable to make the membership $6 a year. It is impossible to get anything good for a small amount of money. We have some of the best men in the State interested in a Southern Independent Fertilizer Company, organized for the purpose of operating a peat bed about 16 miles below Augusta, Georgia, on a line of railway which runs through it. We have investigated the deposit and it gives us nearly 300

acres, ranging from 3½ to 15 feet deep; we have some mixed with clay, but no mull that I can discover. It is from 46 to 52 per cent. organic matter, and from 42 to 43 per cent. mineral matter, but our chemist tells us that that contains a substance that, when it becomes soluble, will stay in the ground and from a combination of nitrogen that makes the peat more valuable as a fertilizer. We are contracting already for a pulverized peat. The price is $3.50 a ton delivered at our station, and from our analysis of the product there is 3.55 per cent. of plant food, in the shape of nitrogen, potash and phosphoric acid. I am anxious to have this Society go ahead, and if you will appoint a committee with me on it, and will have the next meeting at Atlanta, we will furnish enough money to pay the salaries decided upon.

MR. LINCOLN: That's the talk.

MR. BULASK: In connection with what has been said by Mr. Davis, is it contemplated to pay the Secretary for the time he has already put in? If not, I will make a motion that he be elected an honorary member of our Society. (Applause).

THE SECRETARY: I think honorary members should only be men of science, not only in the peat line, but in matters general.

THE CHAIRMAN: The Society desires to honor you on account of the services you have rendered during the four years past, and I think that ought to be sufficient to qualify you for honorary membership.

MR. CRAIG: If this motion should prevail, will it absolve our Secretary from any further services to the Society?

A MEMBER: In all the societies that I have belonged to, an honorary member cannot be a paid officer.

THE CHAIRMAN: I think that is right.

MR. KLEINSTUECK: I think I am one of the very few who know how hard Mr. Bordollo has worked for the Society. It is only a few years ago I heard of a man in New York sending around a little printed sheet on peat machinery. I wrote to him and we got into correspondence, and it occurred to me that he had a lis of the peat men in the country and was evidently sending out reports monthly, and I thought it would be a good idea for him to use the back of the reports as advertising space for peat machinery. I made the suggestion to him, and out of that sheet our present Journal has grown. How he has labored, only the oldest members of our Society know. And, for that reason, we cannot honor him too generously. What we are we owe simply and solely to him. Professor Davis and Dr. McWilliam have done their share, but if it were not for the original movement of Mr. Bordello, there would be no Peat Society, and this work

would not be in its present shape. The movement is going forward in leaps and bounds, and since we are all getting the benefit of it, we will have to thank Mr. Bordollo as the originator.

MR. BULASK: There is nothing in our by-laws that would conflict with my motion. We have elected as honorary members so far, secretaries of foreign societies—and we ought to put our Secretary on a par with them and elect him an honorary member.

MR. LINCOLN: The first duty of the Commitee on Resolutions should be to investigate this motion.

The matter referred to Committee on Resolutoins.

THE CHAIRMAN: Although I offered Controller Hinchey the thanks of the Society for his kindly remarks, I think it would be the proper thing to pass a formal vote of thanks to him before we adjourn.

PROF. DAVIS: I move that a hearty vote of thanks of the Society be extended to Controller Hinchey for his interesting and graceful address of welcome, and I will embody this in a more formal statement to be made a part of the report of the Committee on Resolutions.

Matter handed over to Committee on Resolutions.

PEAT WORK IN CANADA.

THE CHAIRMAN: We are now at the end of this session, with the exception of a paper by Mr. A. Anrep, of the Department of Mines, on Peat in Canada, which we will now hear.

MR. ANREP: My confreres of the American Peat Society: At the request of Dr. Haanel, I am going to give you a brief resumé of my work during the last three years in Canada. It is perhaps useless to say that since my arrival the time has been entirely occupied with peat, peat, and still more peat.

My first summer, that of the year 1908, was spent with Mr. Nystrom, with whose Bulletin you are doubtless familiar. We explored, in all, six bogs, whose aggregate area was about 25,000 acres.

The character of the peat, its depth, ash content and its calorific value in B. t. u., are all embodied in our report for the year 1908-9, Bulletin No. 1.

The object of this work was first to discover and definitely record the true nature and value of the peat deposits in Eastern Canada, and furthermore, to find, if possible, a bog having the essential characteristics for the installation and development of an experimental peat manufacturing plant.

Mr. Nystrom and I decided that the bog at Alfred was in many respects the one most suitable for such a purpose.

The bog has an area of approximately 7,000 acres; of this the

Dominion Government owns 300 acres. Our piece has an average depth of nine feet of well decomposed peat.

The summer months of 1909 (part of July, August and September), were spent in draining and levelling the surface of the bog; about 5 miles of ditches were dug and some of them covered over in a manner described in my report for that year. We also cleaned the surface of about 60 acres, removing all trees and bushes. This prepared us for the erection of the buildings, such as a shed for the storage of dry peat, my office, a blacksmith shop, and for the installation of the peat machine and the accessory parts.

During the season of 1908, part of the machinery now in use, that is, the pulper, was used at Mr. E. V. Moore's peat plant at Victoria Road, but as the rest of that plant did not prove to work satisfactory, the pulper was removed from there to the Government peat bog at Alfred, where it has been set up with other machinery purchased in Sweden and Germany.

In the early summer of 1909 the 34 h. p. engine, the cable system, the field press, the dumping cars, and the portable tracks arrived. We immediately started to assemble and install the plant, so that by October of the same year everything was in readiness for an early start as soon as the season of 1910 should commence.

This year's work was begun about the middle of May, and has progressed steadily since then. During this time about 1,600 tons of peat have been manufactured.

The greater part of this is still on the ground, which has been unavoidable because of the delay caused by not receiving cars for transporting the dry peat to the sheds, and also on account of the scarcity of laborers.

For me to tell you more about the plant would be unnecessary, as we are all going to visit it in a short while. It will afford me great pleasure to answer any questions in reference to the plant, and I want every one to feel at perfect liberty to ask me just as many as he may desire.

For all statistics in regard to cost of operation, production, and general expenses, I beg to refer you to Dr. Haanel's paper.

Bulletin No. 11 also contains a more detailed and accurate account of the work for 1909, and is now available.

Since it was impossible for the printers to finish the report complete with the maps and diagrams in time for this meeting, it has been found necessary to publish an addendum which will have the maps, diagrams, etc.

This Supplement can be procured from Dr. Eugene Haanel, Mines Branch, Department of Mines, at an early date. (Applause.)

The meeting was then adjourned.

EXCURSION TO ALFRED.

In the afternoon the members of the Society, together with a number of Councillors and prominent citizens of Ottawa and vicinity, were taken to Alfred on a special train as the guests of the Dominion Government, and there carefully and thoroughly examined the work being done by the Department of Mines in the preparation, drying and storing of peat fuel.

The plant was in full operation, and for the first time many of the party saw a complete commercial peat fuel plant turning out a satisfactory product in quantity, as shown by the great piles of the dried fuel in the model storage sheds and stacks of different size and form, and the greater amounts in various stages of drying, spread out on the unprotected surface of the bog. The various operations of digging, macerating, transportating by cable-car to the drying grounds, spreading and marking off into bricks, were all going on simultaneously and very systematically, every employee evidently having his duty assigned him and his part, which he thoroughly understood, to keep the operations going at full efficiency. Everywhere forethought and skill were shown in planning the work and efficiency in carrying it on.

The simplicity, power and business-like appearance of the machinery, and the quality of the product, commended themselves to the practical members of the party. The fuel used under the boiler of the locomobile engine was in keeping, being refuse peat and waste from the digging operations; the engine man reported that he had never used more satisfactory fuel for making steam and that he preferred it to either coal or wood.

Not the least interesting thing seen was an imported stove, designed especially to burn peat, in which the air-dried peat bricks produced at the bog could be burned with greater economy than in an ordinary stove, and with the development of very satisfactory temperatures.

The party returned to the city much pleased at the very practical and satisfactory demonstration and convinced that the commercial production of peat fuel in America would be a success if the example set at the Alfred plant were followed elsewhere.

EVENING SESSION.

Monday, July 25th, 1910.

THE PRESIDENT: We have been very fortunate indeed in securing the consent of Hon. Clifford Sifton, Chairman of the Conservation Commission, to address you and say a few words of welcome. (Applause.)

HON. MR. SIFTON: Mr. President, Ladies and Gentlemen: I have been asked to say a few words by way of addition to the welcome you have already received to the city of

Ottawa. The city of Ottawa has a reputation for hospitality and I trust its reputation has been lived up to by the reception you have received today. I may say further, that, while I have no claim to speak with any expert knowledge, that when you have carried out your program and visited the work already begun under the direction of your President, you will have come to the conclusion that the work done by him in connection with the study of the peat question has been of a practical and useful character. (Applause.)

I need not remark upon the nature of the program which has been prepared for your meeting and the evidence it gives of a desire to make that meeting useful. It is characteristic of your President that when he takes up anything he does it with extreme thoroughness and care, and I doubt not that this characteristic will be in evidence in the conduct of your proceedings here.

I have been much interested, and I may say surprised as well, in glancing over the records of your Society, to learn of the extensive and systematic efforts which you have been making to solve the problem of making the most beneficial use of the great supply of fuel which we possess in the peat bogs of America. I have myself found that it very often happens in examining the proceedings of scientific or semi-scientific societies that it took most of the time to separate the wheat from the chaff, that is, to find out what there was worth carrying away, but I have been convinced, in a cursory examination of your proceedings, that that labor was not necessary, for you apparently recognize that, while endeavoring, as you are, to solve an economic problem, it must be done in a practical way, and your proceedings therefore deal very properly with real facts in connection with the problem. Only real results are dealt with. This is eminently necessary in dealing with a problem which is in its nature altogether a practical one.

It is a matter of gratification that you have responded favorably to the invitation to hold your present meeting at the Capital City of Canada. The Government has, by sanctioning this invitation, indicated its appreciation of the importance of your work, and the holding of your meeting here cannot fail to reward the liberality of the Government by helping to diffuse more general knowledge throughout Canada of the present status of the peat question, as well as by arousing a more intelligent interest in that question.

Sometimes in Canada, as well as in the United States, we have been too prone to begin work of an experimental character without making a proper and thorough study of what has been done in other countries. I believe this has taken place in

regard to the manufacture and exploitation of peat fuel and has led to considerable unnecessary loss of capital and energy. The conduct of such meetings as that which you are holding here is the best, in fact, almost the only practical method of making generally available the exact facts of the position.

May I, as an onlooker, make a practical suggestion upon this point? My suggestion is that a competent committee should be formed at each of your annual meetings to frame a short practical statement embodying a summary of the position of the peat industry of the world, in the light of the latest facts available at the time of your meeting. Such a statement should contain exact information in the briefest possible form showing the number of peat plants in operation; methods employed; amount of product; approximate cost of production; use to which the product is put, and other similar informa ion. If printed in your annual proceedings it would constitute a practical reference table on the subject which I venture to say would, as soon as it became known, be effective in circulating very many thousands of copies of your report in quarters where it would be of the greatest benefit.

Your society is working for the purpose of accomplishing an economic result. There are two questions which are immediately suggested in connection with the work and which demand a definite answer.

First, Is the result itself worth the efforts that must be put forth to achieve it?

Second, Is there a reasonable probability of success?

First, is it worth while? As to this I imagine there can be no doubt. What is the object? It is to render available, as fuel, the immense peat bogs of North America. What does success in this effort mean? It means importing a very appreciable factor into the solution of the problem of light, heat and power which will make them more available to the people at large. That is stating the matter in a purely general way. I would like, however, to state it in a more particular way.

We, in Canada and the United States, have been living amid a bountiful supply of the natural sources of wealth. We have hardly known what it is to be in need of anything that is really necessary to existence. In this city of Ottawa, ever since its existence, there has been a constant struggle to get rid of the wastage of manufacturing which, in other situations, would have been of great commercial value. Ottawa is therefore a typically difficult place in which to get people to realize the value of fuel. Some of us who stand here were born upon farms, upon which, when fuel was required, it was only necessary to go out and cut it—the destruction of the tree in itself

was regarded as adding value to the land from which it was cut.

We are, however, coming, if somewhat slowly, to a better realization of what these things mean and, among other questions, we are beginning to realize what the fuel problem means to great masses of people after the supply of timber has been so far depleted that cheap wood fuel is no longer available. In the great centers of population in the Northern United States and Canada—as it is soon to be in its present course of development—the mass of the population will be wage earners, living by their daily earnings and in a climate which, for at least four months of the year, requires a large amount of fuel for family use—cheap and abundant fuel is a necessity of existence.

There are districts in Canadian cities today where families are herded together with insufficient space for health and really civilized life, because of the cost of fuel in the winter, and this condition will tend to increase rather than diminish. The coal supply of the continent is measurably well known, and the conditions of its extraction and marketing are thoroughly well known. It may be safely said there will be no permanent reduction in the price of coal—rather is it reasonably certain that there will be a gradual but steady increase. That is a matter that will bear a good deal of thinking about. We say the price is so much, and with our comparatively few railways we have no possible prospect of seeing coal any cheaper—it will become higher, more expensive and more difficult for the man who earns $1.50 a day to educate his family and keep his house in such a condition as his family can live comfortably throughout the winter. We may get much heat from water power in some localities favored by nature, such as the neighborhood of Ottawa River, but so far, the cost of development, maintenance and management does not encourage us to the belief that we shall be able to make the "White Coal" a poor man's fuel.

I want to read the only authoritative statement I know of about the coal supply. It is short and gives the facts succinctly. It is as follows:

"From the beginning of coal mining in this country (1814) to the close of 1907 there were mined nearly 7,000,000,000 (6,865,000,000) tons. Adding to this one-half additional, representing the waste in mining, gives a total of more than 10,000,000,000 tons taken from the supplies originally available.

"The rate of production has increased rapidly. The average increase from 1846 to the close of 1907 was 7.36 per cent per annum, practically doubling the production every ten years. There has, however, been a decreasing rate of increase in production when considered on a basis of twenty year aver-

ages, and Mr. Henry Gannett of the United States Geological Survey, on this basis estimates the easily accessible and available coal supplies, aggregating 1,400,000,000,000 tons, would be exhausted about the year 2027, and that the entire coal supply would be exhausted about the year 2050.

"As a practical matter it should be understood that coal production will not increase to a certain point and then cease, but that long before the time of exhaustion of supply has been approached there will come a gradual decline in annual production of coal owing to the increasing scarcity and cost. Already the price of anthracite and some other coals is advancing because of exhaustion of thicker beds and increased cost of working.

"The adoption of more efficient methods in connection with the mining and utilization of coal, and the increasing use of water power and other substitutes for fuel in power development will diminish the present increasing rate of consumption, and thereby extend the life of our coal supplies beyond the dates mentioned. On the other hand, it is expected that manufacturing will continue to grow more rapidly than population, and this will increase the rate of coal consumption for power purposes even more rapidly than for heating.

"The factors in the above estimates are sufficiently reliable to make it clear that without a serious lessening of the present rate of coal consumption, either through more efficient use of this fuel or through the extensive development of substitutes for it, long before the middle of the next century is reached the nation's supplies of available coal will be so largely depleted as to bring serious hardship and a curtailment of industry."

There is the conclusion arrived at and it points to the importance, nay to the necessity of developing every other possible fuel substance, and I especially emphasize the feature of it which has reference to domestic fuel, to the importance of it to the population who have not yet reached the more expensive kind of fuel.

In Canada we have coal in Nova Scotia, Alberta, British Columbia—but between Alberta and the New Brunswick line, little coal of economic value, so far as known, but in those portions of the country where there is no coal, peat bogs abound. For instance, in Manitoba there is perhaps the greatest necessity for cheap fuel for the masses of the people, more than any other people in Canada, because this is the coldest province. There is little wood there, but there are great peat bogs. I have seen railway banks burning for days and days at a time and the time will come when these immense bogs at the door of the people of

Winnipeg will be made available for use as domestic fuel. (Applause).

Now, as coal becomes dearer, the difficulty and uncertainty of the supply, of which we have had the very vivid experience in the past, becomes more accentuated, the importance of an alternative and substitute fuel will become more pressing. If therefore the great peat bogs of Canada can be successfully converted into a fuel which shall be, if not so desirable as Pennsylvania coal, yet a practical domestic fuel, substantially cheaper than wood or coal, and abundant and certain in quantity, the boon thus conferred upon the future inhabitants of Canada and the Northern United States can hardly be over-estimated. (Applause.) It will literally mean life and happiness to millions of people.

Not so important, in one sense, but yet of great significance economically, is the influence which peat may have upon the question of light and power. There are peat bogs giving abundance of raw material where there are no water powers. In such localities it will be a simple matter, by the establishment of such plants as that which has been built in Ottawa under the direction of the Department of Mines, to effectively and cheaply produce the light and power required for neighboring communities, and so take an important part in the economic organization of society.

Is it worth while to make the effort? Those of you who are engaged in the work as a matter of business will answer that question in a business way, but, to all of you let me say that there is no effort in connection with the material affairs of life which is so well worth while making, as that which, if successful, will permanently add to the comfort and happiness of great numbers of the people of our race.

It is an unfortunate fact that most of us, from the circumstances of our calling or occupation, are not able to do much which tends to better, in any great degree, the condition of others. The ideal life is that of those who, while following their own avocations, are at the same time laboring for the advancement of knowledge in some field, the cultivation of which tends to promote the elevation and the happiness of the human race. Such a life pursued with contentment, with enthusiasm, with a chivalrous and generous appreciation of the efforts of others, and with an earnest determination to bear as much of what Bacon so well calls "fruit," is the highest form of existence in our modern society.

As to the reasonable probability of success in ultimately effecting a complete solution of the problem of the utiliation of peat fuel, while I have no tit'e to speak with any expert knowledge I express myself with complete optimism. The difficulties to be overcome seem to me to be so slight in comparison with those which have been overcome in other fields, and the attendant bene-

fits so large that I look upon success as not only probable but certain within a very few years.

I welcome you gentlemen as partners and coadjutors in the great work in which I am most deeply interested, the conservation and proper utilization of our Natural Resources.

I welcome you as a body of men engaged in the solution of a practical economic question which is fraught with most important consequences to great numbers of people.

I trust that your meeting will be most successful and that the interchange of thoughts and experiences will add materially to our knowledge upon the important subject which is to be the subject of your deliberations. (Loud applause).

MR. DAVIS: The address we have just listened to has been most interesting to us, and I think we should pass a vote of thanks at once to Hon. Mr. Sifton, and as Chairman of the Committee on Resolutions I take the liberty of submitting the following, with the permission of the President and members of the Society:

RESOLVED, that the American Peat Society tenders a most sincere and hearty vote of thanks to the Hon. Clifford Sifton for his kind words of welcome, for the interest he has shown in honoring us by his presence this evening and for his very learned, practical and valuable address which is an important contribution to the economic discourses on this subject.

We especially appreciate his expression of interest in the importance of the economic question of peat utilization and the practical and helpful suggestions made by him, and recommend their adoption.

The motion was duly seconded and adopted with vigorous applause.

ADDRESS BY PRESIDENT.

Dr. Eugene Haanel, President of the Society, then delivered an instructive address on the

EXPLOITATION OF OUR PEAT BOGS FOR THE PRODUCTION OF FUEL FOR DOMESTIC PURPOSES.

as follows:

In a country such as ours, where independently of the continually increasing amount of fuel required for industrial purposes, we are during the long winters dependent upon artificial heat in our homes, the item of cheap fuel becomes one of the most important factors in the prosperity of the nation. Our coal deposits are situated in the far east and west, and the long hauls to bring this fuel to the central provinces render the price of our own coal prohibitive, and leave us dependent on outside sources for the necessary supply of fuel in these provinces.

The rapid industrial development of Canada and increase of our population render therefore the intelligent exploitation of our abundant and excellent peat deposits for fuel purposes of supreme importance.

We can at present form no estimate of the enormous extent of our Peat Bogs. The 37,000 square miles already known form probably but a small fraction of the amount of this valuable fuel asset in existence in Canada.

The necessity of utilizing the peat deposits scattered throughout the provinces in the more settled portions of them, has within recent times been appreciated, and efforts have been made by some of our enterprising citizens to establish a Peat Industry. Much money, thought and energy have been spent on this problem. Many plants have been erected, but unfortunately so far without reaching commercial results.

Only in rare instances is progress made in improvement of processes of manufacture by those who are unfamiliar with what has already been achieved, and the causes which have led to failure. This may have been one of the reasons why the efforts so far made in utilizing our peat deposits have not been attended with success.

To prevent further failure from this cause in the manufacture of peat fuel, an investigation was made by our Department three years ago, and a report issued on the manufacture of peat for fuel and other purposes in the peat-using countries of Europe.

This investigation has demonstrated that:—

1st. For the economic production of fuel from peat, machinery driven by power must be substituted as far as possible for manual labor.

2nd. That processes so far invented for removing the water content of the peat by pressure and artificial heat have not led to commercial results, and after trial have been abandoned.

At any rate the existence of plants in any country furnishing regularly and at reasonable prices artificially dried and briquetted peat, are not known at our office. The recent reports received by us regarding two very promising processes employing artificial heat in the production of peat fuel are very disappointing: Namely the process of the Electropeat Syndicate, with the head office at Newcastle-on-Tyne, England, and the somewhat famous Ekenberg process.

The Electropeat Syndicate erected an extensive plant at Kilberry in the County of Kildare, Ireland, for the production of a substitute for coal from peat, which they expected to sell at six shillings per ton. No money was spared in trying to make the experiment a success, and most expensive machinery was put down. Experts were brought from Germany to look after the work under the superintendence of Captain Verey, R. E. Large

shipping companies on the strength of samples submitted, and representation made to them, promised some very large contracts for fuel, but the Company, at the end of over one year's experimentation, found that their process was a failure. The peat made by them looked like coal and burned well, but was hygroscopic, and after a short time crumbled to powder. All efforts to overcome this defect failed, and the project was permanently abandoned in June last.

The Ekenberg process for the wet carbonization of peat is exceedingly ingenious, and has aroused great expectations, but is still in the experimental stage after the expenditure of 20,000 kronor in Sweden to place it upon a commercial basis.

The endeavor to accomplish ecnomically by artificial means in a short time what has been accomplished by nature in exceedingly long periods of time, namely the change of peat into a substance similar to coal, has so far apparently not been attended with success. I would not like to say that it cannot be done, since it is unsafe to make any statements regarding the possibilities of future achievement, but at present the outlook in this direction is certainly not encouraging.

In view of these facts, the only proper course for us in Canada to follow, if we desire to establish a peat industry and render ourselves at least to some extent independent of outside sources for our fuel, is to introduce such processes and such machinery as have proven successful and are now in actual commercial operation in Europe.

We may safely leave experimentation and the development of new ideas to the future, when our peat industry is on a secure basis and peat-fuel in abundance on the market. We will then have gained in the manufacture of peat fuel along lines which are at present commercial, the necessary experience to warrant the hope that proposals for modifications and improvements of present processes will be based upon a thorough and practical understanding of the nature of peat and the principles upon which future economy may reasonably be expected. This is a safe proceeding for our country, and above criticism. It will give us the required fuel and prevent waste of capital in experimentation. Departure from this principle has led to failure and the creation of a pronounced distrust in everything connected with peat and the utilization of our peat bogs.

To re-establish the confidence of the people of Canada in the value of peat as a domestic and industrial fuel, and to stimulate renewed activity in the development of our peat resources, the Government has acquired 300 acres of peat bog, with an average depth of 9 feet, for the purpose of manufacturing peat-fuel on a commercial scale, and by a method which has proven successful in European practice. At this plant interested parties will have

an opportunity of ascertaining for themselves the working of the bog as well as the suitability of the peat-fuel produced. The capacity of our plant is a production of 30 tons per day. For a large commercial plant, mechanical excavators should replace the manual labor employed at our plant, if the bog to be exploited is suitable for this class of labor-saving machinery.

The plant at Alfred is to serve as a model of a successful process, and not for the production of peat-fuel on an extensive scale. We expect, however, to manufacture during this season, about 2,000 tons of peat-fuel, part of which is to be used in our peat-gas producer at Ottawa.

There is nothing artistic about the appearance of the fuel produced at our bog. It has not the regular geometric form of briquettes nor their smooth exterior, but it serves the purpose for which fuel is intended as well as briquettes, and has the advantage of being low in cost of manufacture.

Allowing 140 days for a season's operation, the cost per ton of air-dried machine peat, including interest on capital invested, amortization, oil and repairs is as follows:

Cost of fuel on the field.....	$1.40
Cost of fuel stored shed.....	1.65
Cost of fuel loaded on car.....	1.65
Cost of fuel in stack.....	1.70

By the employment of mechanical excavators and the manufacture of peat on a large scale, the cost of production per ton should be considerably less than the figures here given.

The objection to the air-drying process, practiced at our plant, is that it is not a continuous process, that it can be worked only during the summer months and that the amount of fuel which can be produced during one season is dependent upon weather conditions.

These statements are quite true, and yet Sweden, Finland, Denmark, Germany, Holland, Austria and Russia, depend for a large part of their fuel supply on the simple process of pulping the peat, forming it into bricks upon the field and harvesting it as air-dried fuel. The weather conditions in Canada are as favorable, if not more so, for the production of air-dried machine peat as in the countries mentioned. To prevent shortage of peat-fuel on account of unfavorable weather conditions during a season's work, a year's supply of peat-fuel should always be kept in storage.

Russia is the largest producer of peat-fuel in the world. In 1902, the production was 4,000,000 tons of peat-fuel, and the annual increase of production has since then amounted to nearly 200,000 tons. Many private plants exist in Russia in connection with cotton mills for the production for their own use of 200,000

tons peat-fuel annually. 1,300 plants making machine peat are now in operation in Russia.

I admit that the hardness of anthracite permitting long hauls without much waste—the small volume it occupies requiring a minimum of space for storage—and the small amount of volatile matter it contains insuring a nearly smokeless flame, are such valuable properties of this fuel that so long as it can be obtained, it will be used by those who can afford to pay for it. Peat-fuel is, however, admirably adapted for use in grates during the late fall and early spring, when our heating furnaces are not in operation. This fuel will compete in price and cleanliness with soft coal for the purpose stated, in our most luxurious homes. For the inhabitants of our rural districts, villages, and certan parts of our cities, whose homes are not supplied with hot air, hot water, and steam systems of heating but require the use of stoves, peat-fuel will prove a cheap and excellent fuel, far superior to wood, and far more convenient to handle.

Although peat can be used in any of the common stoves now in use in Canada, a stove of excellent design, specially constructed for peat-fuel, has been brought out in Sweden by the Aktiebolaget Ankarsrums bruk. These stoves—a model of which may be seen at our Peat Plant at Alfred—are tasteful in appearance, and very convenient in operation.

The economy, which may be effected by the use of peat is readily understood, when it is stated that in Ontario and Quebec the average price of anthracite with a high percentage of ash, is $7.50, and in Manitoba, $10.00 per ton, whereas air-dried machine peat, containing only about 5% of ash can be manufactured at a cost of considerably under $3.00 for an amount having the same calorific value as a ton of the anthracite we import. This could be sold at places conveniently situated as regards transportation facilities and not too far from the place of manufacture for a little more than one-half the price paid for anthracite in Ontario and Quebec, and for a little more than one-third of the price paid for anthracite in Winnipeg.

Some few years back the labor troubles in the United States taught us a lesson which should be heeded, and which should enable us to conceive what a real fuel famine would mean for Canada. Anthracite coal in Ottawa at that time was sold at $12.00 per ton. What if it could not be got at any price, and if we had to pay the transportation costs of fuel from either Nova Scotia or the far west? Who can even imagine the suffering it would entail upon our population? It is very easy to say that such a state of affairs is not likely to occur, but who will guarantee that it might not?

The central provinces of Canada have accumulated no stores of fuel, ready to be drawn upon in cases of emergency. We im-

port what we need from year to year, and any storage of supply from whatever cause affects seriously our industries and the comfort of our people.

We can not afford, in the light of the past experience, to waste capital on the experimentation for the discovery of proecsses, which shall be continuous in operation and furnish a fuel from peat similar to coal, nor can we wait until someone at sometime in the future will invent such process and demonstrate its commercial possibilities.

Neither should prospective manufacturers listen to the marvellous representations made by promoters of schemes and processes, which promise great profit from production at excessively low costs of peat-fuel superior to anything yet put upon the market, but wisely adopt processes, which are already an assured commercial success in the peat-using countries of Europe.

The Peat Bog at Alfred was acquired by the Government for the purpose of demonstrating to prospective manufacturers of peat-fuel one of these processes, and to prevent failure from choosing bogs unsuitable for their purpose, the Mines Branch has recently undertaken a systematic investigation of the more easly accessible peat-bogs. In carrying out this investigation, our peat expert has been instructed to determine and map their extent, ascertain their depth and also the quantity, character and calorific value of the peat contained in them. So far, twelve bogs have been investigated, mapped and reported upon. In case of need the staff performing this work can be increased to meet the requisitions made upon the Department.

The successful inauguration of a Peat-fuel industry in Canada may be looked forward to with confidence if, content to accept European practice, we establish peat plants at stragetic points on the workable bogs scattered throughout the farming regions of those provinces, which require to import coal, and operate them in the interest of the neighboring communities. This will avoid long hauls, for which air-dried machine peat is not fitted.

Regarding the transportation of peat-fuel, our railroad companies, realizing the importance of an adequate fuel supply for the central provinces, and its intimate connection with the prosperity and further development of these provinces, should come to our aid by granting special rates for transportation of this class of fuel. This is the course followed by Germany in those districts which depend to a large extent upon peat for their fuel.

Air-dried peat is not alone an excellent fuel for domestic use, but for the production of power it proves an ideal fuel in the peat-gas producer, which is today, as reliable and efficient in its operation as the coal gas producer. I do not hesitate to say that it is an ideal fuel because the peat from bogs is free from a clinkering ash and yields on combustion, a fine white residue which

really allows of the thorough cleaning of the fire, and the property of not fusing or caking in the producer assures regular operation. Moreover, since gas leaves the producer with a high degree of sensible heat which must be cooled to the temperature of the atmosphere before being used in the gas engine—it is exceedingly important that as much of this sensible heat as possible be utilized in the producer itself, in order to increase its thermal efficiency. This is accomplished in coal-gas producers by the introduction of water vapor which passes through the incandescent fuel with the air supplied for combustion. This water vapor is decomposed, yielding hydrogen and oxygen. The latter combines with the carbon of the fuel forming carbon monoxide. This chemical reaction absorbs a large amount of heat and lowers the sensible heat of the gas, but the heat absorbed in liberating the hydrogen is to a large extent restored and utilized when the gas enriched by hydrogen is burned in the gas engine or other apparatus. With peat containing from 25 to 35 and more per cent. of moisture, the moisture content is sufficient to accomplish all that is required without the introduction of water in the producer from an outside source.

To demonstrate the value of peat for the production of power for industrial purposes, a modern German peat-gas power plant has been erected by the Department in Ottawa. Its capacity is 60 H. P., and consists of a double fire zone Körting peat gas producer, with the necessary gas cleaning apparatus, and a Körting four-cycle single acting gas engine direct connected to a Westinghouse 50 K. W. direct current generator.

While no definite figure can at present be given of the consumption of peat per brake horse-power hour, since the investigation begun some time ago is not yet completed; our preliminary trials, however, bear out the results obtained in Swedish and German plants, where the amount of peat consumed per brake horse power hour ranges from a little over two pounds to about three pounds, depending on the calorific value of the peat employed. Since the peat of the different bogs so far examined has a high calorific value, we expect that our figure for the consumption of peat per brake horse power hour will be in the neighborhood of two pounds.

The erection of gas producers designed for the recovery of by-products is not recommended except in localities where such by-products would command a ready and profitable market. In Canada it is far more economical to aim at the complete gasification of all the heat elements in the fuel.

Peat-gas producers for power purposes should, whenever possible, be erected on the bog, and the energy generated in the form of electricity transmitted to neighboring towns and villages for

power and lighting purposes as in the case of water power. This is the policy adopted in European countries.

Whatever other valuable products may be obtained, such as moss litter,peat mull, alcohol, packing paper, millboards, ammonia and nitrates, the great and important need for us in Canada is the production from the peat deposits of a constant reliable supply of fuel for domestic and industrial purposes.

When this has been attained and peat fuel is put on the market in abundance and sold at a reasonable price, we shall not alone have rendered ourselves to a great extent independent of outside sources for this necessity, thus enabling us to retain in our own country a large part of the capital now spent annually for the purchase of fuel from abroad, but a new era of industrial development will dawn upon our nation, and we shall here see repeated what has been accomplished in Europe,—the establishment of large industrial concerns on the waste areas of our country underlaid by peat, and the wide stretches of these solitudes will become resonant with the welcome sounds of industrial activity. (Hearty applause).

MR. RANSON: The statement is made in the paper that the peat plant which we saw this afternoon would produce peat for $1.50 a ton, and two pounds will give a horse power for one hour. That means that one horse power an hour can be sustained for one and a half mills, or 1,000 horse power for a fuel cost of $1.50. This shows it is cheaper than any water power that we know of, so far as the results of the gas producer goes.

MR. CRAIG: How was the size of the bricks we saw this afternoon determined upon? Why are they not made twice the size?

Mr. ANREP: It would be very difficult to dry them—the conditions will not permit of it.

PEAT POWER GENERATION.

Dr. T. Arthur Mighill, of Boston, was then called upon by the acting Chairman, Dr. McWilliam, to give his address on Peat Power Generation. He said:

Mr. Chairman, Ladies and Gentlemen: In what I shall have to say tonight I will discuss the general situation of the peat power proposition, as it has been my duty during the past year to find out, if possible, if power in large quantities can be generated from peat practicably, and to that end I have talked with anyone who would talk to me, and have traveled over the United States considerably. I have also conducted, in a small plant of our own, experiments to see what is necessary to be done in order that peat may be profitably turned into power. To some of you the points I bring out may not be new, but these are presented in order that

those not familiar with the problem of power may understand it a little clearer. Anything I have to say in the paper will be understood as prior to the work of the Dominion Government in the peat line.

The proposition of developing power from peat is not an easy one upon which to pass judgment. There are so many elements involved, each only partially solved, that we are not in a position at present to show in exact figures its practicability. The reasons for this are as follows: There is as yet to my knowledge no plant in operation where peat fuel is handled entirely by machinery from start to finish. I believe that digging the peat, moving pallets, or gathering dried peat by hand is impractical, if peat fuel is to be manufactured cheaply enough to compete with coal. Locally this may be possible under present methods. I am also aware that some processes which may be said to be successful in what they attempt to attain, have eliminated the most of the hand labor. However, from the point of view which I shall take in this paper, there is much yet to be done. We learn of successful peat power plants in Europe. However in America we are not able to operate under European conditions. We must pay laborers higher wages than prevail in Europe, and we do not employ women and children upon such work. Should I be mistaken and learn of some process which would make the use of peat-fuel for power purposes on a large scale, an industrial success, unless it eliminated all hand labor, apart from the operation of machinery, I would still maintain that there was room for economy.

Should it be claimed that any part of the process can not be carried out except by the use of hand labor, I would reply that I believe this position to be erroneous and that soon we will see machines handling peat from the time it leaves the bog until it is shoveled into the producer. I take this position because I am looking forward to the production of electrical power in plants comparable in size with our present ones using coal for fuel; and what I may have to say in this paper bears upon plants of say 2,000 horse power output operating continuously.

As far as the generation of power is concerned, if small units of 250-500 horse power can be made successful, and present results seem to show that they can, there does not seem to be any reason why the size of the plant can not be enlarged indefinitely, as I have learned that it is quite practical to run gas engines of this size driving electrical units in paralled. The real problem is the production of such an amount of fuel as will be necessary for a large sized plant.

As peat is a fuel of low calorific value, averaging from 6,000 to 9,000 B. t. u. per pound of dry substance, while many coals run from 12,000 to 15,000 B. t. u. per pound, we may say that

one pound of good coal is about equal to two pounds of average peat.

When dug from the bog, peat is not in a condition fit for burning but must be dried. To do this economically is the great problem in preparing peat fuel, for any purpose.

In developing power from peat its heat energy must be transformed into the chemical energy through the agency of either the steam or the gas engine.

While peat, when burned under a boiler, will generate steam, the quantity used compared with coal will be about as two to one and its small density necessitates the use of a larger grate area than for coal and the fuel must be frequently fired. The ashes are light and easily removable. The flame is long and should put the heat where it will do the most good, in the tubes. From its light and pulverent nature, when the draft is forced, considerable might find its way into the stack before complete. One thing unfavorable is that, in a power plant situated at the edge of the bog, the water most accessible, the bog water, is not well adapted for boiler use on account of its organic impurities.

For small plants of a few hundred horse power it may not be practical or desirable to erect a producer plant and gas engine on account of the simplicity of operation of the steam boiler and engine.

I am advocating the use of the producer gas engine system in large plants not on account of any defect in using peat fuel but on account of the larger heat efficiency of the gas engine.

In contemplating the use of peat fuel as a source of power we must consider the practicability of the process and also the economic conditions connected with the locality. We must consider the price of coal at the locality and the cost of preparing the peat fuel, remembering the ratio of two to one which I just spoke of. The farther the bog is removed from the coal fields the greater the possibilities of the peat proposition. The matter ends here if the power is to be used for factory purposes, but if electrical energy is to be sold, consideration must be given to the situation of the bog relatively to the community to be served. As electricity can be easily distributed over a considerable distance, the bog may be some distance from the region served, but the plant must be at the bog. Freight charges must be eliminated.

In producing power from peat we have to consider:

First—The preparation of the fuel.

Second—The gasification of the fuel.

Third—The transformation of the heat energy of the gas to electrical energy.

The first proposition includes digging the peat, drying and

storing it. The second proposition is concerned with the gas-producer. The third deals with the gas engine.

I do not anticipate any serious trouble with the gas engine. However, a few words regarding it may not be out of place here.

In heat efficiency the gas engine surpasses the steam engine by about one-half. In operation, however, it does not behave as well as the steam engine. First the efficiency of the gas engine is best at full load. With diminishing load it falls off much faster than the steam engine. Second, it is good for only about 10 per cent. overload while the steam engine will stand some 50 per cent overload for several hours. This is important in an electrical plant where the greater part of the load does not exceed 20-30 per cent. of the overload. Third, it does not run well unless the gas supplied be fairly constant in heat value; although it can be made to run on a poor gas as well as on a rich one. Lastly, there is a multiplicity of parts, and breakages are frequently reported. Plants carry sometimes quite a stock of duplicate parts.

Engines of sufficient size for such a plant as we are contemplating are easily obtainable. Such a plant would have several machines of perhaps 500 h. p. each.

The combined efficiency of the producer and gas engine may be stated most clearly by saying that in a certain system a horse power hour is obtained from the consumption of a certain amount of fuel. Under the very best conditions it may be said that approximately h. p. h. may be obtained from one pound of coal of good quality, though experience has shown that more than this amount of coal is generally consumed.

As regards the installation cost of a steam or gas engine plant it is not an easy matter to decide, as size of plant affects the matter so vitally. However, I have at hand estimates of the cost of a plant of 2,000 kilowatts capacity showing the cost of a gas plant to be 25 per cent greater than the cost of a steam plant.

The next thing which we will consider is the producer. Here the fuel is partially burned. The issuing gas is combustible and consists of a mixture of carbon monoxide, carbon dioxide, hydrogen, some hydrocarbous, and nitrogen. To understand the action of peat in a producer a few words upon the theory of the producer will be pertinent. When carbon is burned with an insufficient supply of air, or the bed of incandescent fuel be quite deep, say four feet, it is burned to carbon monoxide. With the escaping gas goes the exchanged nitrogen of the air. When a pound of carbon is completely burned to carbon dioxide 14,640 B. t. u. of heat are liberated. When the product is carbon monoxide 4,410 B. t. u. are liberated. There are therefore 10,230 B.

t. u. available when the carbon monoxide is burned. The heat recoverable being 70 per cent of the total heat possible gives an efficiency to a producer operated in this manner, and neglecting heat losses, of 70 per cent.

As the gases of a producer must be covered before they can be used in a gas engine this 4,410 B. t. u. represents lost heat. This heat can be partly recovered by decomposing water injected into the producer. This liberates hydrogen and carbon monoxide by the action of the incandescent fuel upon the steam. The addition of these gases to the gas of the producer increases its heat value and thus the lost heat of the producer is partially recovered.

The efficiency is hereby raised to some 80 per cent. At the same time the introduction of steam is of value in lowering the temperature of the fire, because it diminishes the formation of clinkers.

The above simple reactions are not all that occur in a gas-producer, but I have said enough for the purpose of this paper.

Owing to the large amount of nitrogen in producer gas 50 per cent to 60 per cent, which is inert, the calorific value of producer gas is low compared to coal or natural gas. The report of the U. S. Fuel-Testing Plant at St. Louis for 1904 gives values of producer gas from 140 to 160 B. t. u. per cu. ft.

As the tests there reported were made upon bituminous coal these figures represent about the top notch of producer gas. Gas made from anthracite would run quite a little lower. Gas can be used, however, with a value as low as 100 B. t. u. per cu. ft.

Of natural fuels, anthracite works best in a producer and is generally used in connection with gas engines. However there are possibilities of using bituminous coal, lignite, wood or peat successfully. The solution rests on the elimination of the tar, which must not reach the engine.

Different designers of producers attempt to remedy this difficulty by various devices. Some use up-draft producers and scrub the tar out of the gas. Others use down-draft producers and decompose the tar with a formation of lamp-black. Still others use a divided draft in the producer draining the gas from the middle of the fire, or a double zone producer.

Let us now examine peat fuel. This, we all know, is a complex substance largely cellulose, composed of carbon hydrogen and oxygen, with a small amount of combined nitrogen, and, as generally prepared, containing a considerable amount of water. There is also a certain amount of ash which is often quite large.

As a sample of the composition of peat, my analyses of the peat at our bog gave 5.7 per cent. hydrogen, 58.690 per cent.

carbon, 1.990 per cent nitrogen, 28.6 per cent oxygen and 5.2 per cent ash, figured on the dry substance. It has a calorific value of from 6,000 to 7,000 B. t. u. per pound. As peats from the same bog vary widely in composition, analyses do not show much about peat in general, and the above sample is perhaps as illustrative as any. The ash in peat is very important and should be determined, for it may vary from the purest peat with under 4.90 per cent ash, to a peaty clay with any amount of ash, sudden variations often occurring in the same bog.

I have made considerable inquiry whether peat ashes will clinker badly in a producer. I have received no satisfactory answer. In our own experiments at Pittsburg we found some clinkers, but I can not say that it was any worse than coal in this respect. I suspect from the fineness of the peat ash, that the possibilities of any large amount of it fusing together into an unbreakable lump are not very great. However, if the peat is too finely divided the drafts will find holes or chimneys and here the combustion will be most intense, favoring clinker formation. The lightness and porosity of peat is a drawback, for the combustion may be so rapid in places that the holes are rapidly formed. This necessitates considerable poking of the fire; and every poke of the iron makes a possible path for the air. The lightness of the fuel and lower calorific value greatly increases the size of the peat producer over the coal producer for the same power capacity.

The content of water in air dried peat makes the running of a producer uncertain, for to my mind there is quite a difference between running steam on to incandescent coke as in an anthracite producer and leaving the steam liberated in the fire itself at a rate which, from the very nature of the operation, must be very irregular. Under such condition the producer may run now too hot, now too cold and the heat value of the gas vary greatly.

This raises the question, how much water can peat contain, and be used successfully in a gas-producer? This point is of such vital importance, as it has such an effect upon the whole drying process in making the fuel, that it ought to be determined. When I look for information upon this point, however, I am disappointed. I believe it must be proved out by trying fuels of various content of water for long periods, and not by the short runs, the accounts of which are accessible. I have met the assertion that peat can be used in a producer with as high a content of water as 50 per cent. I have based much hope upon the possible truth of this, as it cuts down the drying expenses so much. But I believe that such fuel contains too much water to burn well and that 30 per cent—35 per cent moisture is about the limit that can be allowed.

Evaporation of water in a producer only to have it condense again unaltered as is inexcusable unless we are going to recover ammonia as in the Mond process, or else find some compensation in the preparation of the fuel whereby we rob the producer to save the drying field.

It has been already shown that to attempt to recover by-products except in very large plants of 3,000 h. p. and over is impracticable.

If the temperature of the producer gets too low through the evaporation of so much water the carbonic acid is not decomposed, and the calorific value of the gas is correspondingly lowered.

Thus far I have been unable to find any record of a test where the producer was fed on a fuel containing 50 per cent moisture.

The form in which the fuel is applied is of great importance. We have records of runs in this country where machine peat and briquetted peat were used. I anticipate no trouble in using briquettes but I believe the expense of manufacturing them does not warrant their use, and further I believe that properly machined peat is just as good. I am not a believer in the idea, which I have had presented to me, that a producer can be run on anything that is combustible.

We experimented in a run of about two weeks, two years ago at Pittsburg and found that peat dug out of the bog and not machined but thrown onto the ground to dry, did not make a fuel suitable for producer purposes. We did not dig the peat out in blocks as is sometimes done in Europe, but filled a car with the fresh peat and dumped it on the ground, afterwards spreading it out to a thickness of several inches. This dried peat was loaded into a railroad car and shipped from Massachusetts to Pittsburg. In all it was shovelled over about 10 times before it was burred in the producer. The result was that there was so large a percentage of fines in it that the draft through the producer was greatly clogged, and the suction rose so high that the operation of the producer became a source of danger. As a result we got poor gas, high in carbonic acid.

To operate a producer successfully on peat the fuel must be prepared by machining it, and drying it so that it hardens into lumps and does not produce much fines on handling.

When we look for a producer that will gasify peat so that the gas will be suitable for engine use, we will only find a few that promise success. To be successful the producer must be so constructed that the tar will be decomposed in the producer leaving little to be scrubbed out later. I believe that there are several producers now in operation which are running satisfactorily on peat. A bit of my experience, however, may show that

while there has been a great deal done to accomplish the destruction of tar in producers, there has not been much success.

I am not speaking only of peat but of the bituminous coal situation also. Three years ago I went around the country and interviewed the principal manufacturers of producers. I asked them all if they thought that peat could be satisfactorily used as a fuel in producers for gas engines. Most, I think all, thought that it could be so used. None had tried it on any large scale; most, not at all. I tried to find if any of them had bituminous producers operating in connection with gas engines. Though there were designs for such producers, I was able to find only three in operation. One was in Indiana. I went there but they were shut down on account of the business situation. The engineer in charge, however, told me that the producers worked satisfactorily. I heard of another, operating with fair success in Colorado, upon lignites. I also visited a plant of the Boston elevated railroad where they used a down-draft producer. The producer worked very well but they had to shut it down to clean out the ashes once a week. The report of the engineer, Mr. E. Nystrom, to the Canadian Government upon peat and lignite in Europe mentions, with considerable data several plants in Northern Europe, using peat in producers with evident success. The plants were small, however. Several tests have been made by the United States Government upon peat in producers which were short on account of lack of fuel, but encouraging. It seems that the difficulty of testing peat is owing to the inability of the producer people to get enough of the fuel. I found many quite willing to make tests if we would furnish the fuel.

I am confining myself in what I am saying to work done prior to the elaborate tests now being made by the Canadian Government from which we hope to hear later, I trust, with encouraging words as to the practicability of using peat as a producer fuel.

The last problem is to make the fuel. I will touch only on what I believe to be the requirements to produce a fuel suitable for making producer gas.

In the first place let us get some idea of the amount of peat required to operate a plant giving an average of 2,000 h. p. during the year. It is not pertinent to regard the variations in load at this point, and I do not imply that such a plant would be rated at 2,000 h. p. I mean that its average output would be 2,000 h. p. each minute throughout the year.

Reports which are available of tests on producer gas plants show an expenditure of from 1½ to 2½ pounds of dry peat per h. p. h. Let us assume two pounds of say 9,000 B. t. u. per pound which would represent an excellent quality of peat.

As it is impracticable to use perfectly dry peat, more pounds of less calorific value must be used. Let us assume that the peat contain 33 per cent moisture. We know peat of this content of water was used successfully in and it seems to be the most practical state of dryness to attain. The two pounds of dry peat we assumed would be increased by one pound of water making three pounds of such a fuel necessary to develop one h. p. h. As the data from which I made the above assumption were gathered from the operation of small plants we would expect a large plant to do better. However, we will in this discussion abide by the above assumption of three pounds of 33 per cent moisture peat per h. p. h.

This would require excavating from the bog 480 tons of raw peat, with a content of 90 per cent moisture each 24 hours. As bog peat has about the same weight as water, which weighs 62½ pounds per cu. ft., let us assume this as the weight of a cu. ft. of raw peat. I am also assuming a bog undrained, or imperfectly so, as the density of peat increases with the dryness of the bog.

An acre of such a bog for each foot of depth would furnish 1,360 tons of raw peat which at 90 per cent moisture would yield 136 tons of raw peat equivalent to 204 tons of peat, with 33 per cent moisture. Since our plant consumes 72 tons of such fuel per day, one acre-foot of peat would last about three days, and a square mile one foot deep would last about five years. A bog would then have to cover a square mile and have an average depth of 10 feet to last the plant 50 years.

I think I have brought out clearly enough the magnitude of the peat end of the proposition to discuss here how this amount of material can be handled and dried.

In order to produce a peat fuel which shall be cheap enough to compete with coal, recourse must be had to machines capable of excavating the peat, transporting it to the drying ground and gathering it up.

The best way of digging an undrained bog is with a steam dredge with a dipper bucket, though the clam shell or orange peel bucket might be used if they can be kept tight. The peat must then be carried ashore on barges where it can be lifted by mechanical conveyors to the bins over the peat machines. If there are logs or stumps in the peat they must be removed before unloading the barge. Smaller stuff might be screened out just before machining. Unfortunately peat has such peculiar properties, running almost like water when churned up much, and sticking like glue when somewhat stiffer, that it is difficult to design machinery to screen the peat without much experimentation. Peat might be churned in the bog into a pulp and pumped ashore, but here it would have to settle and an artificial bog

would be created on shore, which would have to be operated upon like any other bog.

In well-drained bogs the process of excavating the peat could be different from that outlined. Rails can be laid on the bog and traveling machinery operated by steam or electricity could be used to advantage. A macerating machine can be made a part of the same outfit and the machined peat carried ashore on cars, or to the part of the bog used for drying, if the bog surface be thus used. This is essentially the European method.

Climatic conditions have so great an influence upon the drying of peat that it is impossible for me to say how long peat must be laid out in order to dry it sufficiently. I think that the season in the Northern United States and Canada can hardly exceed six months and will, in most places, probably be less, unless the locality is one with slight rainfall. If we assume the drying period to embrace six months, then during that time the fuel for the whole year must be prepared. In the case of our plant of 2,000 h. p., there would have to be prepared each day 144 tons of fuel with 33 per cent. moisture.

Most important is the time necessary to dry the peat. This varies with the extremes and middle of the season, set-backs by rain, heavy dews, and possible frosts; on the average, peat properly laid out may reach the necessary degree of dryness in from two to three weeks, if it is not spread too thickly. My own experience in Massachusetts has shown that if the peat is spread out some four inches thick, a product suitable to pick up can hardly be obtained in less than three weeks. As my object is not so much to show what has been done in specific localities, whether better or worse than this, as to show the conditions attending a peat power proposition, I will assume that the drying field, whether bog or upland, will be covered to an average depth of four inches every three weeks throughout the season of six months.

One acre of drying ground covered to a depth of four inches would contain 472 tons of machine peat, 900 per cent. moisture content, or 71 tons of air-dried peat of 33 per cent. moisture. The acre of drying ground would be covered nine times in our six months' season and the peat fuel produced per acre for the season, that is, per year, would be slightly over 600 tons.

Our 2,000 h. p. plant requires 72 tons of fuel per day, or 26,280 tons per year, when continuously operating. It would therefore require 44 acres of drying ground, or about one-fifteenth of a square mile. I think that in most places this area would hardly be sufficient. Should the peat be laid out in cakes the space would be somewhat increased by the vacant spaces between the cakes, unless the cakes be made correspondingly heavier. Peat in this form would dry quicker than in sheets and

the efficiency of the ground would probably be much increased.

Experience has shown us that the use of drying shelves is out of the question in handling such quantities of peat, on account of the cost and deterioration of lumber, if the houses be made ample enough to secure the necessary circulation of air. Further, it is not an easy matter to fill the shelves and unload them entirely mechanically.

Two other ways of removing the water from peat often suggest themselves to peat manufacturers: pressing the water out and evaporating it by heat.

I would not say that peat presses are an impossibility, but at the present time I do not think that the inherent difficulties have been overcome. It requires fine screens to hold the peat and great pressure to force the water out. Filter presses or machines of this type work too slowly to handle so much peat. The requirements of a peat press are continuous operation, rapidity of operation, great strength to withstand high pressure, and screens that won't clog up but which will hold the peat from passing through.

To remove a small percentage of the water by using a press would not be worth while; however, if half of it could be removed, subsequently air-drying the peat, it would be profitable to do so.

It must be remembered that if half the water in raw peat be removed the residue still contains 82 per cent. water; if 75 per cent. be removed, the residue still contains 69 per cent. To produce peat with 33 per cent. moisture 94.5 per cent. of the original moisture must be removed.

The use of heat is often proposed; to show the impracticability of this, let us take a peat which is very high in heat value, say 10,000 B. t. u. per pound dry substance. This pound of dry peat comes from the bog associated with nine pounds of water. To raise the temperature of nine pounds of water from 70 degrees F. to 212 degrees F. and evaporate it at the latter temperature would require 9,972 B. t. u., or almost exactly what we assumed as the heat value of the dry peat. With heat losses it is evident that peat cannot be burned to furnish heat to dry more peat.

The waste heat from the producer and the exhaust gases from the engines might be utilized in some way to finish the drying of the peat. The exhaust gases might be passed through the dry house, but the waste heat from the producers could not be easily utilized, as it would require an enormous amount of piping, for the hot gas at this stage must be confined.

The peat should be removed from the drying field by mechanical gatherers. To remove such an amount of peat will require strong and durable machinery. The gatherers must be designed to lift rather large pieces of peat and not clog or break;

they must move on rails and be propelled by power; when loaded they will carry the peat to the storage bins.

These bins must have a structure which allows a circulation of air and protects the peat from rain. Peat stored out of doors absorbs rain water and deteriorates by the winter frosts.

If peat be dried to 50 per cent moisture, or under, it is uninjured by frost alone and so can stand winter cold. It has been shown by others, and we have corroborated it, that peat should not dry too long in the hot sun, as it becomes brittle. A better fuel can be obtained by partially drying on the field and finishing under cover with a good circulation of air.

As half a year's fuel must be stored for the winter, it is evident that the storage plant must be quite large on account of the amount stored and its bulky nature. As about 13,000 tons must be stored, if we consider a cubic foot of peat fuel to weigh 25 lbs. the volume occupied by this amount of peat will be 1,000,000 cubic feet.

We have proved that storage bins can be constructed so that even during the winter peat will continue drying.

I will not give any estimates concerning the expense of operation such as a peat plant, not having definite enough data as yet. I do believe, however, that by using machinery, peat fuel ought to be manufactured for $1 a ton or less. If so it can compete with coal at $2 a ton.

In conclusion, while the peat power proposition has much that is promising about it, I do not think that any one is in the position today to guarantee that it will be a paying one.

So many are working upon the ideas bearing upon the problem that I believe it will soon be solved and we shall see before long a peat power plant in operation in this country. (Applause).

THE CHAIRMAN: This paper is of great interest. I will call upon Mr. F. J. Bulask, of Toledo, to say a few words on it, for if it is correct the writer sweeps away from me some ground on which I have been building. He tells us a plant requiring a small amount of power would not be successful if an attempt were made to run it by a peat gas producer. My own dream has been this, that in the counties from which I come, although not much water power, in every few miles we have a mill that requires a small steam power and my dream has been that those factories would yet be induced to put in small peat gas-producers and gas engines and thus develop their power at a cheap rate to them and furnish a market to us who are trying to develop the peat industry. In the counties I travel through we have many small peat beds and with the processes now developing, the peat in those beds could be made to do good work and my dream has

been that factories in the towns would some day in the near future be supplied with power from their surrounding bogs. There was another thing he said I do not agree with—that electricity from a central station can be easily distributed. That is not my view—it requires a very extensive piece of ground to be obtained through the municipality—the people are very much frightened of it and it has to be patrolled regularly to see that things do not go wrong, there has to be a telephone line, and I hold it is a very expensive thing. That is what costs the most in regard to the Niagara power today and my dream has been that the small gas producer plant and gas engine, is the hope of the future and the hope of the peat industry in Ontario.

DR. MIGHILL: I agree with you in the main, but by what I said about small plants I did not mean to imply that they were not successful. I meant I did not think it would pay a small manufacturer running a small gas power plant to put in a gas-producer or a gas engine, but if you are going to supply electricity to a small community I certainly would advise putting in the producer. As regards the distribution of electric power, Dr. McWilliam is the first person I ever heard express the idea that it was a serious matter to distribute that power. I know our own firm distributes any quantity of it. We have 30 or 40 different plants and all selling power and I never heard that idea expressed by any one connected with that concern. I do know, however, from conversation with a man connected with our own work that it is extremely difficult to get a right of way. In Massachussetts we were tied up a long time on account of one man. But considering a proposition of developing a power in a country not so thickly settled I think you will not have so much difficulty in securing the right of way, and as to the maintenance of power and care of line, I can hardly see why that could not be done easily. Electricity goes for nothing except for loss of voltage along the line. It does not appear to me nearly as expensive as paying freight on fuel.

MR. ANREP: Dr. Mighill states that one cubic foot of peat is equal to 62 pounds—how much moisture did it contain?

DR. MIGHILL: Assuming peat of 90 per cent of moisture and that weight I calculate as something near the weight of water. My point was to say how much fuel in a general way was necessary. Peat is very near the identical weight of water in our place. The peat often sinks in water and we have difficulty in keeping our pumps clear. What do you consider the weight of a cubic foot of water?

MR. ANREP: 65 pounds.

DR. MIGHILL: That would account for the difference in my calculation.

MR. ANREP: One cubic foot of peat weighs 39 pounds.

PROF. DAVIS: The weight varies from 15 pounds to the cubic foot to nearly 65 pounds. Mr. Ranson's peat in Florida is so heavy when air dry that it will sink in the water. It is very difficult to say without actual tests what a cubic foot of peat actually weighs.

THE CHAIRMAN: One time Mark Twain and James Whitcomb Riley were traveling together giving entertainments; they acted as chairman night about, and on one occasion Mark Twain remarked "Ladies and Gentlemen, I will talk to you until I am tired and then Mr. Riley will read to you until you are tired." So I will ask our friend Mr. Bulask to come and read to you until you are tired. (Applause).

WORK OF THE PEAT ENGINEERING COMPANY.

Francis J. Bulask gave the following paper on "The Work of the Peat Engineering Company:"

The work of the Peat Engineering Company is rather ambitious in scope embracing the manufacture of machinery and the manufacture of practically all products from peat, with perhaps the one exception of peat paper.

The actively engaged personnel of this company has a combined experience in peat of over twenty years, and in looking back over this period, one fact stands out head and shoulders over others, that is, the enormous amount of money, time and energy spent, with such little results.

Before going into details of our work, it may not come amiss to inquire into the cause and effect of this, our present day status. In no other industry in this country, which had its beginning in the last twenty years, may the same be said. Instance, as a criterion, the manufacture of beet sugar, portland cement, etc. These had long years of service in the old country before being put to use here, without the loss of any appreciable amount of money. The peat industry in this country has this same counterpart in Europe today, but our hurdle-riding, steeple-chasing American was not content to follow practices long years of experience had established, but, at the outset, decided to go the slow-moving, sure-footed foreigner one better. Naturally, the result which today is our history of peat fuel.

In summing up the various causes of failure in this country, after studying over the schemes for using artificial driers—by the way, experimenting with which the speaker has paid out quite a few hundred dollars — centrifugals, electric decompositions, vacuum moisture extractors, etc., all of which would have more or less merit were it not that they cost too much to install or to operate.

One of the most important features, in fact, the most important in peat fuel manufacture, seems constantly to have been lost sight of, namely the necessity of charging against the cost of one pound of dry fuel, the power required to drive the machinery, or the heat necessary for drying purposes to produce it, as well as the fixed charges on investment, together with overhead charges, depreciation, advertising, etc.

The above methods we are pleased to term "American methods" and although similar experiments have been conducted from time to time in the old country, it was with more reason, as they were pioneers, and we, on the contrary had only to read the history of their endeavors to learn the folly of these efforts.

In summing up the cause of failure of foreign machinery in this country, which gives such splendid satisfaction wherever used in Continental Europe, the causes above mentioned, with the addition of too much hand labor, which, at prices current in this country makes the use of such machinery almost prohibitive. Therefore, the most prominent causes of failure brought out are inexperience and too many laborers.

To overcome this state of affairs the Peat Engineering Company felt peculiarly fitted as its experience covers both European practice and American endeavor. The outgrowth has been successful ,although a radical departure from all accepted methods. Instead of digging by various means from six to nine tons of water, transporting this in cars or scows to the factory containing the grinding mill, and from there conveying it to drying ground by wheel-barrows, belt conveyors, etc., in order to obtain therefrom one ton of dry fuel, at too great a cost with its comparative market value, our chief engineer, Mr. Herbert Garnett, some years ago evolved what we consider the greatest step forward in the successful and economical production of a ton of peat fuel or filler stock, a (portable) traction trackless peat fuel machine, one of which has recently been put in operation.

This machine has been described in the April issue of the Journal of this Society. To those, however, who have not seen the account, I will explain its principal features:

The machine has a platform about 4x12 feet, with extended "I" beams projecting in front and rear; in front to support the windrower, of which we will talk more later; in the rear the spreader is attached, and springs connected with the "I" beams are held in position over it to hold the spreader to its work and at the same time to help distribute the load of the machine by giving the spreader some of it to carry.

The machine proper is a platform or truck mounted on multipedal wheels, furnishing sufficient support to enable the

machine to travel over a very wet bog. In fact, experiments made to determine the carrying capacity of a square foot of bog of varying moisture content, and for different depths of peat brought forth some very interesting results, considering the machine as a dead weight and as traveling.

The machine weighs something over three tons, the motor delivers the power separately to the worms and driving shaft so they can be run independently. The forward speed of the machine is approximately three feet per minute, during which time the worms are digging a trench 20 inches wide by three feet deep. The machine may be speeded to six feet per minute, materially increasing its output, and for larger capacities, a double set of worms have been designed which will deliver the equivalent of from six to ten tons dry peat fuel per hour. The worms having serrated edges and traveling with an upward spiral motion, cut the peat into small particles the moment touched. The worms overlap each other and thereby give that splendid mixing found so desirable in most foreign machines. In fact, the cutting and mixing is as thoroughly done as with any of the complicated foreign machinery. The peat thus dug and treated emerges from the top inner side of the worm casing, drops into a sluiceway, is deposited on the ground, covered by the spreader and spread out into an even layer, and cut into layers by the disk on the spreader without any hand labor whatever. The only hand labor required is that needed to steer the machine and a man or a boy to crosscut, into suitable lengths the ribbons of peat that have left the spreader. An automatic, cross-cutting device has been designed for use on machinery to be built later.

The machine travels in a straight line, if the bog is large enough, for an entire day, this, for a three ton per hour output is calculated to be about 1,800 feet. The treated peat is laid out on the bog along side of the ditch which furnishes an excellent drain for the peat, the constant weight of which on the bog squeezes some of the free moisture in the bog into the drain, thereby making a splendid porous and absorbent drying ground. The next day the machine, after turning, repeats the first day's operation by enlarging the 20-inch ditch to 40 inches and laying out a similar amount of fuel on the other side of the widened ditch. After this, the machine travels to a line 75 or 100 feet away and parallel to the first ditch and repeats the first two days' operation. This is done frequently until the first peat laid out is comparatively dry, when the machine returns to the starting point and the windrower is attached. On this is a set of traveling teeth mounted on an apron, moving at the rate of 30 feet a minute at right angles to the machine. This attachment when set in operation, throws the peat into

a windrow making room for the machine to travel, while widening the 40 inch ditch to 60 and 80 inches. Repeated frequently, the windrows are brought close together until after the operation described has been carried on a number of times, the peat is ready for the storage pile, laid out in closely parallel lines and has been turned sufficiently without hand labor. A portable track is then laid between the windows and the peat can be loaded without any unnecessary foot travel.

When the top layer of peat has been excavated and converted into fuel, the second layer is attacked if the bog is too deep to remove all of the peat at one cutting, the machine is always digging drains, which are in some instances two or three feet below the peat laid out to dry. In turning around and moving from place to place the machine can be speeded to three miles an hour.

Later, as experience warrants, we aim to arrive at standard sizes capable of, as Mr. Garnett remarked the other day, "of floating if necessary."

Enough has been said to give you an idea of the great possibilities latent in this style of machine, some of which we can not go into at this time on account of the patent protection we desire to obtain. But sufficient has been said to open up a discussion of the practicability of the machine for general use.

Before this is done, however, I wish to say that our experience has demonstrated that an undrained bog is hardly the one of which to make fuel, owing chiefly to the cost of excavating the equivalent of a ton of dry fuel.

With the method described, the bog is being continually prepared for a better product. It is well known that a bog, which before draining delivers from 150 to 200 tons of peat per acre foot, will, after a year or two, deliver 250 to 300 tons per acre foot. The reason why more drains are not put through the bog is that their probable cost is not productive of direct results.

If anyone questions the feasibility of using the surface of a bog for a drying ground we refer him to Europeans who dry nine-tenths of their peat fuel on the bog. If this is not sufficient, we suggest that he read for proof the article entitled "The Irish Peat Question," Vol. 2, No. 3, of the Journal of this Society.

What the success of this machine means to the peat industry of this country may be conjectured when we take into consideration the amount of labor required for stationary plants in the old countries as well as for all but one of the plans projected in this country. We do not wish to be understood to say that the Schlickeysen, Strenge, Heinen, Dolberg or Anrep machines are not successful peat fuel machines. We would be contradict-

ed in this statement instantly, and justly so. The idea that we desire to convey is, that although these machines operate successfully in the old or in this country, the cost of the necessary labor to operate them makes their use more or less prohibitive. There are places in America where labor costs compare favorably with those in parts of Europe, but all will agree that these localities are few and far between.

Today there are 15,000,000 tons of peat fuel manufactured in Europe. The market is greater in this country and would have been largely developed within the last ten years had the stumbling block THE RIGHT KIND OF MACHINERY, been removed before this. There are inquiries from all over the country for peat fuel machinery, peat fuel or kindred peat products, all of which heretofore had to be answered more or less with promises, and as failure after failure was recorded, those closely following the endeavors of others, knowing full well the pit-falls, took a tight grip on their pocketbooks and remarked, "We are from Missouri; you certainly will have to show us." This our company is now prepared to do. It aimed to have a full sized, tested out machine on exhibition at this convention, but as this was called earlier than we anticipated, and as the machine at Fort Wayne, Ind., was built on contract, it could not be accomplished.

The success of this machine in fuel making and as an adjunct to a peat filler plant, has already gone over the country, as it also does the work which is now done more or less by hand, or by machinery originally built for other purposes. It is well known that raw peat dug and then put into a pile, dries very slowly if at all. The labor required to plow, harrow, drag, and windrow the bog is often lost on account of rains or heavy winds; either method requires a number of men and a number of handlings, and one is never positive of the result of his labor. With this machine, however, employing the same method as for fuel, small losses are caused by rains, as it is well known that rain, unless an exceedingly heavy downpour, affects the ultimate result but little where machine peat is concerned.

After drying down to same moisture content as for fuel, the peat is collected in the same way, and taken to the storage pile where, note,—and this is important—there is little danger from spontaneous combustion, as with powdered peat, carefully sheltered, and small losses are occasioned by strong winds. Another and as important feature is the low cost, so far, of the filler stock. It is then broken in a suitable breaker, and fed into the drier as in some other methods. Peat filler prepared in this way assumes that desirable black color which we understand some manufacturers supply with graphite. The cost to produce a ton of filler stock containing not more than 20 to 25 per

cent moisture, by this method, should command the attention of all peat filler manufacturers. The success of this machine, in fact, the success of any machine doing like work will soon give an impetus to this business and open the portals to a number of industries now dormant on account of the lack of a cheap fuel.

A machine of this kind holds the key to the economical production of fuel, fertilizer filler, coke, and producer-gas-electricity, and what the latter means, to those who are not familiar with the subject, I will refer to an article written by Prof. C. A. Davis, published in Cassier's Magazine of August, 1910, entitled, "Gasification of Peat with the Economical Recovery of By-Products."

I may with pardonable pride, be allowed to say, with the aim of going on record, that we are probably the first in this country to almost completely eliminate the labor question in the manufacture of peat fuel and kindred products. We are satisfied that the use of any traction track or automatic peat fuel machines will mark a new era in the development of our peat resources. (Applause).

The meeting then adjourned until next morning, Tuesday, July 26th.

TUESDAY, JULY 26, 1910.

Morning Session.

PRESIDENT HAANEL: The program this morning relates to the business of the Society itself, and as I have considerable work to do in making further arrangements in connection with the convention, I call upon Mr. Robert Ranson to take the chair.

Nominating Committees Report.

The report of the Nominating Committee was then submitted by the Chairman of the Committee, Professor Charles A. Davis, as follows: "The Committee on Nominations presents for your consideration the following names for officers for the ensuing year:

For President, Dr. Eugene Haanel.

For Vice-President:

Eastern States, John N. Hoff.
East Central States, Karl Kleinstueck.

West Central States, L. B. Lincoln.
Southern States, Robert Ranson.
Pacific States, C. V. Imeson.
Canada, Dr. J. McWilliam.
New York, Dr. Charles McKenna.
New England, O. E. Moulton.
Minnesota, Max Toltz.

Secretary-Treasurer, Julius Bordollo.

Executive Committee, Herbert Philipp, J. N. Hoff, C. H. McKenna.

"The other two members of the Committee to be chosen by those."

In presenting the report Prof. Davis remarked that the region of the Great Lakes and Mississippi Valley which had been a single Section was a big country and one vice-president was too few for such a large territory, and in view of the fact that there is a certainty of the formation of a new section in the territory, it is suggested by the committee that two vice-presidents be elected for this region, one including Illinois, Wisconsin and Iowa, and the other, the eastern part, including Michigan, Ohio, Indiana and such other territory as is adjacent. The Minnesota Section has been formed since the last meeting and the meeting which they held in March brought forth a paper on the peat resources of Minnesota which opened up a lively interest in the matter. I am going to take a moment to say that no better way can be devised to interest the general public in the work of the Society than to hold meetings and exhibits such as was held at St. Paul. If nothing else is attempted at the meeting than the presentation of a paper on the possible uses of Peat it is still worth while.

THE CHAIRMAN: All the officers are on the paper except the essential one of Secretary. The newly created officers on the executive committee, Messrs. Philipp, Hoff and McKenna, with two other members to be chosen by them, are to act in connection with the Secretary to relieve him as much as possible from the responsibilities of the management of the Society.

MR. CRAIG: I move that the Secretary deposit a ballot for the officers as recommended, himself included as Secretary.

Motion was duly seconded and carried.

THE CHAIRMAN: The next matter of business is the selection of our next place of meeting.

THE SECRETARY: I have two letters, one from the Mayor of Kalamazoo, and one from J. D. Clement, of the Commercial Club, of Kalamazoo, as follows:

"July 23, 1910.

"The American Peat Society, in Convention Assembled, Ottawa, Ont.

"Gentlemen:

"I understand that the place of meeting for your next convention will be settled while in this session, and on behalf of the municipality of Kalamazoo, Michigan, I desire to extend to you a very cordial invitation to meet in our city. Mr. Carl G. Kleinstueck, of our city, vice-president of your Society, if given an opportunity, will speak for Kalamazoo, and we believe that we shall be able to make your stay with us pleasant and profitable.

Trusting you will give this communication due consideration, I am,

"Yours very truly,

"(Signed), Chas. H. Farrell, Mayor."

"July 23, 1910.

"American Peat Society in Convention,
Ottawa, Canada.

"Gentlemen:

"We have noticed the growing interest in your Society, and realizing the importance of the fuel question, we very much desire your Honorable Body to consider our city when making selection for your next meeting.

"Vice-President Carl G. Kleinstueck, being a resident of Kalamazoo, has expressed a willingness to accept the chairmanship of the local entertainment committee which will ensure the success of the meeting so far as the arrangements at this end are concerned.

"The Commercial Club representing the principal commercial and civic interests of the city, with a membership of about 400, wish to extend to your Society an invitation to meet with us at the next annual meeting and promise you our assistance in every way possible in making the meeting one of both pleasure and profit.

"Yours respectfully,

"The Commercial Club,

"J. D. Clement, Secretary."

MR. LINCOLN: Kalamazoo is only a short distance from a city containing millions of inhabitants, including those of the surrounding towns. There are at least 1,000 people in Chicago who have lost money, about $500 each in the peat business, and that is proof of the great interest taken in it in that vicinity.

MR. KLEINSTUECK: I can not sit still here and see a little town like Chicago trying to take the honors from Kala-

mazoo. Chicago is nothing but an overgrown village and the fact that not a soul in Kalamazoo has lost money on peat makes it the best place. Anyway we have no invitation from Chicago and should we go there perhaps we would not be wanted at all.

MR. CHARLES WARREN DAVIS: I move that Augusta, Georgia, be our next place of convention, and if you come to our town we will show you some fine fertilizing peat beds.

THE CHAIRMAN: There is an invitation from Augusta.

On a vote being taken Kalamazoo was selected as the next place of meeting by a very large majority.

Report of Auditing Committee.

MR. CRAIG reported on behalf of the Auditing Committee that they had audited the report of the Treasurer up to the present time and found it satisfactory. The report of the Managing Editor of the Journal was not audited as the date of its fiscal year differs from that of the Treasurer.

MR. BULASK, Managing Editor of the Journal, presented a statement of the affairs of the Journal which was accepted and placed on file.

The report of the Auditing Committee was adopted and the thanks of the Society tendered to the Managing Editor of the Journal.

REPORT OF FINANCE COMMITTEE.

MR. BULASK submitted the report of the Finance Committee.

Item 1. That membership be increased to $5.

MR. LINCOLN: I thought every one could pay 50 cents a month and make it $6 a year.

MR. CRAIG: May I offer a suggestion—you have two classes of members, one of active members who might pay $5 and the other class of associate members who are not entitled to vote but entitled to all the publications of the Society who should pay $3.

On motion the item recommended by the committee was adopted.

Item 2. All money received from membership be sent to the Treasurer at once. Carried.

MR. BULASK: In explanation of that, there have been several Sections of the Society organized during the past few years and those who collected the money failed to send it in thinking they would have to have 20 members in order to form a Section. In the meantime those who had joined did not get

the Journal, and that is the reason why we make the recommendation.

Item 3. A Board of Trustees shall be appointed to act in conjunction with the Secretary and meet every two months. Carried.

Item 4. That a propaganda committee be appointed.

MR. BULASK: In talking over with some members I found they were willing to constitute themselves a committee in order to obtain members and we thought it well to recommend that a propaganda committee be appointed, the chairman, Dr. Haanel, to make the appointments.

Items carried:

Item 5. That the Journal be forwarded to the leading libraries in the United States and Canada.

MR. BULASK: We have concluded to recommend this. We tried last year to get the libraries to subscribe but only 13 responded. Many wrote and said they could not subscribe, but we thought it an advantage to put a number of important libraries in the United States and Canada on the subscription list.

A MEMBER: What extra expense would that involve?

MR. BULASK: It would involve about $350 a year including mailing and other expenses.

MR. CRAIG: There was something said yesterday about having one or two salaried officers and the object of my question is simply to find out where we are drifting to financially for the coming year.

MR. BULASK: We are only to do this if the finances allow. If the committee allow us, I think it is the greatest propaganda work we can do.

THE CHAIRMAN: The point raised by Mr. Craig I think is well taken and I think the Secretary and the chairman of the committee can be relied upon to administer the funds and not to swamp the association by sending out too much literature.

PROF. DAVIS. Many of these libraries are paying for journals not as valuable as ours. I am not so sure that free distribution is going to be the best thing for the treasury or for the libraries themselves. Something for nothing seems to me to be not the best thing. They say this journal does not amount to anything as they are getting it for nothing. That is simply my private opinion and I am not sure that we can do so very much by giving away the numbers of the Journal except as the means of increasing our circulation.

MR. MOORE: The object is to get people interested in peat and its possibilities and I do not see any better way of reaching the people than having the Journal placed on the tables of the libraries. Very few will know that it was placed there without subscription. Therefore if it does conflict with the present finances, I would be in favor of putting the Journal in the most prominent libraries as many people will be apt to become interested in Peat in that way.

Item carried.

Item 6. That the services of a stenographer be engaged.

THE CHAIRMAN: I would like to ask under whose charge the stenographer should be.

MR. BULASK: The Committee think it would be wise to apportion the stenographer's services to the Secretary.

Item carried.

Item 7. The Journal to be published every two months.

PROF. DAVIS: I am vitally interested in this. If the members of the Society would do their duty, they could have the Journal once a week instead of once a quarter. The collection of material for publication is very hard work. I could do it easily once a quarter, but not once in two months. It involves the necessity of getting in one long article and two or three short articles and a few items. If the members will send in items for publication it will help greatly to increase the value of the Journal, for, with the exception of the Managing Editor and the Secretary, I get little help, but have to browse around and get items the best way I can. I published notices in the Journal asking for statements of what is being done by the different branches, but I find I get nothing in return. Nobody pays any attention to such matters. I learned through a Chicago firm that so-and-so, a member of a certain Section, is expecting to do something, but I never hear of it until the information gets to somebody else. I am supposed to know what is going on, but I cannot write regularly to all interested in this work, requesting this information. The latest news I am supposed to give is not the latest news, for it almost invariably comes to me from a press clipping agency. Hence I am very decidedly opposed to increasing the number of issues of the Journal until there is better co-operation on the part of the members. I have sought and now seek the help of the members of the Society; I have asked them to send me items of news, but so far, in three years of hard work, I have received very few contributions. I have used up now every scrap of manuscript on hand for publication of the last number and the papers presented at this meeting will be all that I will get through the year, except what I write myself; that is if the experience of the future is to be like that of the past. I can get out a lim-

ited number of pages of new matter, but the quantity is limited and I want that understood. If you prefer a smaller Journal issued oftener, it might be possible to give it, but I favor the quarterly issue until we get more matter. I think we had better keep the Journal as it is.

MR. CRAIG: As a sort of an outsider—I happen to own a small piece of bog land. For two years I was trying to get information about peat, but I did not succeed in getting on the right trail until I happened accidentally to notice the announcement of this meeting in a New York newspaper. I never knew there was such an association in existence, although I attended the Jamestown Exposition. I got in communication with the officers and in a few reports sent to me I obtained more tangible and practical information on the subject of peat than I possibly could have secured through the methods by which I had been seeking to obtain information, during the last ten years. Now, in considering this question and also in connection with your propaganda resolution, I think it would be well to keep in view the kind of men whom you seek as members of this Society. There can not be many more experts to join you, and it must be the laymen. Now a publication published once a quarter that gives a layman something that he can understand and appreciate is better than one that is published once a month or once a week that he will not read.

MR. LINCOLN: Mr. Craig would intimate that there are not many interested in peat. It is just the men who want information who are interested and their esteem for the American Peat Journal is not very high because they say information is cold when they get it. I think if published more frequently it would bring more benefit to individual members of the Society and people in general. If objections are made because people are reluctant to send information, I can state that, for one, I never knew the managers of the Journal wanted material. We are all busy men, but if we know news of the different sections is wanted, we would send it at once and not wait until tomorrow, and I am in favor of having the Journal published as often as possible. The Journals of the old country come out often. They contain much matter of interest. The interest is here, but the lack of knowledge is absolutely apparent. I think if Mr. Davis can get assistance he can get out the Journal every month.

CHARLES W. DAVIS: I move that we continue the Journal as in the past. I am satisfied that four numbers a year will have all the material that is worth while. The peat industry is a matter of evolution and it evolves very slowly. A person starting to study the matter thinks great things will be accomplished in a

year or so, but no such thing occurs—progress goes on very slowly, and I am convinced that issues four times a year would contain everything worth considering. We have had the advantage of foreign journals, but there is so very little in them that is applicable to this country that it is not worth while spending the time on them. Any one who has not obtained the numbers of the Journal for the last four years is at a distinct loss. Those journals contain all the information on the subject of peat, and I therefore move that we continue the Journal as it is for another year and wait for copy to pile up more abundantly before making any change.

THE SECRETARY: If every member wrote four letters a year to Mr. Davis, it would be very interesting—we like to know what is going on in different parts.

MR. MOORE: I am more inclined to the opinion of Mr. Davis than of Mr. Lincoln. I think Mr. Davis' remarks are most pertinent—we cannot make a Journal without material. If we could get the material it would be desirable to have a more frequent issue. I make an amendment that the Editor be given authority when there is sufficient material, to publish an extra copy of the Journal without appealing to the Society.

PROF. DAVIS: There is always the need of new presentation of old matter. That we can do because we are teaching. The Journal is not published for the benefit of experts, but for people who are not experts. One of the most valuable things will be criticisms of the papers published, and I would be obliged if you could pick out errors in the papers, from your own point of view. When you begin doing that it will improve the Journal and increase our power. After all, it is the facts—it is not theory—that we have to face. It is a statement of your actual work that would add materially to the value of the Journal and I hope that this will be borne in mind. I would like all of the published papers criticized. If published this morning, sit right down and write me that this is right here and wrong there, and I will publish the criticism in the next issue. Send such letters at once when you see the fallacies. None of the papers are perfect, and I myself am going to publish corrections of certain papers of my own.

THE CHAIRMAN: I do not think what we have done in the past is any guide for the future. What happened last year is not a guide this year. From the growing interest being manifested, different conditions are required. I have just received a word from the Editor saying my paper sent in some time ago was not to be published until a later date.

PROF. DAVIS: I have to divide up the good things I have on hand. If I were to publish all the good papers first, the subsequent issues would be somewhat flat. I divide up the matter to

get out the Journal so that the numbers will be on an average in point of merit, and there is no way of doing this except as at present. That is the reason I took the liberty I did with Mr. Ranson's paper.

Item carried.

PROF. DAVIS: There seems to be a misunderstanding in regard to the expenses of the Journal. Mr. Bulask and I were given charge of the publication of the Journal, and there were several expenses incurred, such as hiring a stenographer. These have been assumed, but now we want the authorization for it.

DR. McWILLIAM then read a paper submitted by Alexander Dobson of Beaverton, Ont., entitled 'A History of the Peat Industry in Canada,' prefacing the paper with the remark: "I will read this paper and I think it will interest you to get a statement from one who has been interested in the peat industry and one who has done more than any other person in Canada and perhaps the United States in the cause of peat. His paper is as follows:"

REVIEW OF THE PEAT INDUSTRY IN CANADA.

About fifty years ago an attempt was made to manufacture peat into fuel for the Grand Trunk Railway, by the Canada Peat Company, whose works were situated on a bog near Farnham, Quebec. They were so far successful that for five years an entire division of the Grand Trunk Railway was almost supplied with fuel from the products of the works.

The machinery was installed on a large scow, which floated in the water of the bog, where the peat was from 10 feet to 12 feet in depth. The excavator was in the form of two large augers, which bored their way into the peat, and this cleared a track for the scow to run in.

After the peat was taken from its natural bed it passed into a puddling tank, where it was well worked up to give it density; then water was added, so that it would flow as thin mush through a pipe some sixty feet in length, which swung in part of a circle and enabled the mush to be distributed pretty evenly over the face of the bog.

After a week or so, depending on the weather, the mush was found to be sufficiently dried to run a marking machine over its surface, which marked it off into blocks of about 16 by 8 inches, and as the mush was about 10 inches deep when deposited, the sun cracks followed marks made on the surface, resulting in blocks of peat 16 inches by 8 inches by 8 inches being formed over the entire deposit.

After another week or two these blocks were broken apart and set up in little stooks (with the wet side out), or if not dry

enough for this, were turned upside down to permit the bottom side to dry. When the stooks got dry, the peat was ready for market.

The difficulties to overcome in this mode of making peat were uncertainty of weather and securing labor for the summer months at reasonable rates.

The fuel, when in good condition, proved effective, but as no sheds were supplied by the railway for storing the fuel, it was so wet at times that the engine men used to speak of taking on a load of "manure," instead of fueling up. The handling of the fuel in dry weather was a drawback, as the clouds of dust from the dry and broken peat were a frequent cause for complaint, as the engine men at times could not see for it.

The price of coal having fallen one-half during the five years referred to, the coming of a new superintendent on the division, and the delivery of a large quantity of peat that was frozen instead of cured, were the factors in the refusal of the railway company to continue using peat as fuel, and as the enterprise was on its last legs, this proved its death blow and the company was disbanded, losing, it is understood, their capital invested.

In the short sketch of the first peat plant in this country, you will notice it was worked on the "wet process." Now I will give you something on the "dry process," introduced into this country by A. A. Dixon. The plant was put up on the Welland bog, a three-press plant, expected to turn out three tons per hour. This operated for about four years, in which time they did a lot of experimenting, only turning out a few cars of peat. There were a good many reasons why this plant did not pay. There was about 18 inches of moss and berry bushes to be cleared off the surface, which is a very expensive job, as any person will find. Then the bog, when cleared, was full of roots and trees only half rotted, which made it impossible to run any machinery with satisfaction. They tried many kinds, and even if the inside machinery had worked, they would have had enough trouble with their bog to make it a losing deal, as the peat would not dry enough to press, and this is the cause of all the failures in the peat business. After all the means had failed to get the peat dry by the sun, Mr. Simpson, the manager, designed and built a drier. This drier was a double drum, one above the other, and had a capacity of about 500 pounds per hour. Then it was found the Dixon press would not work on kiln dried peat. Then the company arranged with the Peat Machinery Supply Company for a press, which was set up. I went up to start it, and after running the drier all day, we only had enough dry peat to run its press about two hours, and to dry it had cost about double what the manufactured peat was worth, so I called up the president, and told him the sooner he closed up the

plant the better for himself. Before leaving this plant, I should say the name of the company was changed four or five times.

This brings me to the next plant, and much nearer home, namely, The Trent Valley Peat Company. This was also a three-press plant, and was put up on the Trent Canal, near Victoria Road. This plant had also the Dixon machinery, but the process of getting in the peat from the bog was very different. The bog, being flooded by the canal, the peat was taken out with a steam dredge, put into large boxes or baskets in a scow, and was towed to the works. The boxes were then taken and run along a cable about 40 feet high and dumped in a large pile. Then it was fed into two large presses, which squeezed the water out of the peat to some extent; in fact, it was claimed to reduce it from about 85 per cent. to 60 per cent. It was taken from the press in cake form, about one inch thick, and run through a breaker, which broke it up fine. Now it was ready for the drier, which was a large Cummer drier, made in Cleveland. It was run through this to the stock bins, above the presses, and then pressed into briquettes. This company, finding wood for fuel too high, installed a peat gas producer and used the gas as a fuel under the drier and also under the boiler. This was the most complete plant I have ever seen; all was fueled up in first-class order. The only trouble with the plant was, it burned all the peat it made; in other words, the drying process was a failure and closed the plant up.

Now we come to the Brockville plant, which was a Dixon two-press outfit. All I need say about this is that the bog was what is called a "grass bog," and was not suitable for fuel. Any process would be a failure there.

Then the "Perth Peat" was another plant, installed with the Dixon machinery. The bog was good for fuel, but the same trouble came up as in the other plants: the peat could not be dried cheap enough, and the cost of running the press was too high, as the expense of repairs and new tubes was very great.

On a bog west of Toronto the Stratford Peat Company put up a plant, installed the Dixon process; but this also came to grief after making a couple of cars of peat fuel. This bog was very shallow, but very good quality.

Then the Chatham Peat Company spent some money putting up a plant on a grass bog which was flooded most of the year. I need hardly say this was a failure before the plant was completed.

I may say all the above plants except the first were using the Dixon machinery.

But I understand that there was another process at work up near Stratford, which is called the "Milne" dry process. I am not in a position to say much about this plant, as I have not seen it at work.

There was also some kind of a plant put up at Newington, which was kept a secret, but I understand it has gone to the wall, like the rest.

I have not said anything about Mr. Moore's plant at Victoria Road, as I understand Mr. Moore will be present at the meeting and will give his own experiences on the wet process.

Beaverton Plant.

Having called your attention to the different peat plants I know of, I will now give you my own experience.

Like the above plants, I started in with the Dixon press and breaker, which was all that was supposed to be needed to make peat. I started in at the same time as the other companies did, in the spring of the year.

I had quite an advantage over the others in the bog, as mine was cleared and had been cultivated, and only about one mile from Beaverton. The peat is of good quality and very easily drained. I started in as instructed by Mr. Dixon, just as soon as the frost was out of the bog and cut out peat and piled it up to dry, turning same when one side was dry. As I started the building the same time as I started taking out peat, I had quite a pile when the building was finished, and it took me well into the middle of the summer to get the machinery installed. I used the peat as fuel the first season to run the plant. As soon as the peat struck the breaker I found, after two months in the pile, it was not dry enough to press. As soon as I found this out I started to find some means of drying it. I was told by the company that sold me the machinery that I could not dry it by direct heat, as it would spoil the fuel, so I built a steam drier, using the exhaust steam on one plant and live steam on the other. It took me about six weeks to get this started. It took twenty minutes for the peat to go through and it was no drier when it came out than when it went in. I could feel it a little warm, but that was all. Right here I knew that the Dixon Company, that sold me the machinery, knew nothing about it, so I quit taking their advice and went on my own way. I got a piece of 24-inch smokestack about 25 feet long, put a shaft through it, built it in with brick the same as you would a boiler, fired the same way, and found I could dry peat all right. Before I got this drier going it was late in the fall, about the end of October. As soon as I got a little through the drier I ran it through the press. I was so anxious to see how it burned that as soon as the first few blocks were made I took them home with me on my bicycle, put them in the fire, and you can imagine how pleased I was when they made a nice fire.

Having found a way to dry the peat, I ordered a large drier and had it put in the first thing in the spring, thinking of course I

had got over all my trouble, as I had made a few tons of peat which gave good satisfaction. However, I found I was only started, as the second spring was wet and the weather unsettled, so could not get the peat dry enough to go through the breaker, and as I had used up all I had dry in the fall, I was up against it again. Then I got figuring out the cost of digging peat by hand, packing it up and turning it over. I found the cost too high, so I started to experiment on machinery to dig it out, and soon had a machine at work.

This machine I kept on changing and improving till my present peat digger and spreader is the result.

This machine can dig and spread 300 tons of peat in ten hours with a 10 H. P. motor. When I got these machines running successfully, I thought I had got over the greatest difficulty, which to my mind confronted peat manufacture on this Continent, that is the high price of labor compared with what they have to pay in Europe, as I had some time before this concluded that unless some method could be devised for the handling of peat that would do away with expensive manual labor, that it would be impossible to manufacture peat profitably on this side of the ocean. So effective were the methods adopted and so perfectly did the various machines described above do the work required of them, that it was possible to pile up a large quantity of air dried peat, containing about 65% of moisture at the very minimum of expense, and now that I could get my peat dry enough to go through the breaker and my system of drying by direct heat could handle it so easily, I thought my troubles were over. This was not so as I ran up against the most discouraging part of the whole business, the Dixon press would not work properly. The expense to keep this thing going was so great, that it made the manufacture of peat with it impossible. Here again, I had to give up or build a press, with the chance of getting one to work. I decided to do some experimenting, and the third season I had one going, which ran right along, making from one to one and a quarter tons per hour. This press I ran for a number of years, in fact till I found I could not dispose of my peat. In the meantime I had kept on improving my field machinery, built a scraper to scrape the peat over to the track, and a loading machine, which loads it into a car, all run by electricity, and the car to take the peat into the building. I can safely say, I have the most complete plant in existence, for cutting, drying and taking in peat, and as my plant is going every day, I extend a hearty invitation to all the members of the American Peat Society to visit it and see for themselves what twelve years of experimenting on peat has come to.

I will now say a few words about the two plants filled up with the Dobson machinery, the one plant at Alfred, (on the

same bog as the Government plant) is fitted out with a two press plant and a double drum drier. The principal reason it was closed, was the same as my plant here for making fuel, namely, we could not sell the peat for fuel.

The plant at Fort Francis, I am sorry to say, was burned down a few days after we got it going.

In conclusion, I would say the principal reason the peat could not be sold, was the fine dust which came from it in handling. If this could be got over, I believe the peat industry would be a great success. The dust was the same reason the engineers kicked on in the first plant, which was erected at Farnham, Que.

In concluding this review of the attempts to manufacture peat fuel in Canada, which has resulted in the loss of so much capital, I feel that I should draw your attention to what in my opinion has been two at least of the principal causes of failure.

First. The popular opinion is that any peat bog is suitable for the manufacture of peat fuel, but this is a very erroneous idea. I have at the request of various parties, examined, tested and made reports on a great many peat bogs, not only in Canada but in the United States, and I find that the majority of the bogs for one reason or another are unsuited for the manufacture of peat fuel, so anyone contemplating going into this business will find that it is money well spent, and perhaps save heavy losses later on, if at the beginning they have a competent expert make a thorough test and report on the bog before incurring any further expenditure.

A second cause of failure has been the attempt to use machines which had not been thoroughly tested in the handling of peat, which on account of its peculiar nature, is much more difficult to manipulate than any other I have ever come in contact with, and it was only the fact that I had a great liking for mechanics myself, and did not like to be beaten after paying my good money out for the Dixon machinery, which was represented as being thoroughly tried, that prevented me from throwing up the sponge, instead of sticking at the problem, part of which I was at least able to solve after long experimenting and inventing the machines necessary to economically handle the material in its various stages, and as I said earlier in the paper, I will be pleased to have any of the gentlemen present visit my plant at Beaverton, either now or later, and see the machines in operation for themselves, or they could see my digger and spreader in successful operation at two peat filler plants down in New Jersey. (Applause.)

It is surprising to know that 50 years ago locomotives on the Grand Trunk Railway were run by peat fuel.

PROF. DAVIS: I consider this paper one of the most

important we have had. It gives historical reports of failures, it is true, but it is only by noting the failures of people going before us that we learn and are able to make progress.

MR. LINCOLN: It is not 50 years ago that the Farnham plant was started—it was in 1878 that the Central Vermont Railroad was starting up and a part of the capital then invested in the peat plant was supplied by one of the officers of the Grand Trunk Railway. The peat was dug with a double set of augers, having a diameter of 12 feet, and they are still in existence. A ticket agent, then a conductor, said the cause of the failure was not lack of storage sheds, but that there were so many orders and such crowding for money that the peat company put out the peat with 60 percent moisture, so that the engines stopped right on the way—the steam gave out.

GEORGE C. HOLLAND: Mr. Chairman, I wish to correct another paragraph in that report, or rather supplement the information conveyed. I was a member of the company which established the plant at Newington. The process was not secret. The attempt did not fail because of any defect discovered in the process—it failed because sufficient capital could not be enlisted to carry on the enterprise to completion. The objection of the dust from the peat did not apply to the peat made there—we made some peat. It was dug out, in the first place from a wet bog by German diggers and carried by conveyors up to the machine, run out into trays and conveyed on trucks into chambers where it was dried by a hot air blast, and the moisture was carried off as steam. That hot air blast glazed the briquettes and they were so hard when they came out of the chambers that no dust rose from them when they were handled. Our enterprise failed because we were unable to get sufficient capital to complete the work. We wanted to equip the trucks with trays to handle large quantities and thus operate the plant more economically, but the capital could not be found and the whole affair finally fell through and we all lost the money we had invested. I make that explanation because Mr. Dobson evidently did not know the cause of the failure.

THE CHAIRMAN: Mr. Dobson speaks of two plants in New Jersey. I want to say that the operation of his diggers there is most successful. They are used every day at Mr. Hoff's plant about 8 miles from Hackettstown, New Jersey. The machine travels along very slowly driven by an electric current through a trailing wire, revolving wheels cutting the peat at the top of the bog and one day after it is thus spread, the peat is brought down to 45 per cent moisture, and then the electric collectors gather it into long windrows.

At Woodridge, N. J., they had trouble with this machine because of the fine stones in the bog which would get in and break the knives. So far as I know it is the most successful excavating machinery for use on dry bog. It is a little difficult to discuss a paper profitably when the author is not present, but as we are liable to mistakes, I think it will be well if these mistakes are pointed out after the publication of the paper in the Journal.

A NEW PORTABLE PEAT MACHINE.

MR. ERNEST V. MOORE, of Peterborough, Ontario, was then called upon. He said: The remarks I have to offer are really a continuation of the argument in favor of the automatic excavator and of the self-drier peat plant supported on a peat bog without the use of rails.

I have not been able to prepare such a paper as I would like to read at this meeting. I wrote Mr. Bordollo that there was a question of my being able to prepare anything at all but I see he has taken much for granted and as I do not wish to shoulder the responsibility for a blank in the very interesting program that has been prepared, I shall say a few words.

On a previous occasion I made public some of my ideas with regard to peat fuel manufacture. That paper, possibly known to some of you, was written when my experience was much more limited than at present. Since that time I have profited much by association with such men as Messrs. Nystrom and Anrep of our Government staff here, with Mr. Carlsson, instructor at the Royal Swedish Peat College and Peat Expert of the Swedish Government and with Mr. Lincoln, General Manager of the Canada Fertilizer Co., one of the best read men on the subject of peat that I have ever had the pleasure of meeting, and from all of these men I have learned much.

Referring for a moment to my former statements, perhaps it is sufficient to say that the only correction I have to make is in regard to my own plant at Victoria Road, the essential feature of which was an area constructed for artificial drying. After a thorough trial and in the light of the knowledge I have gained, particularly through my association with the gentlemen from Sweden, I frankly say I believe I was not on the most promising track in my efforts to facilitate drying by a specially prepared wooden drying area. I am still of the opinion that such a plant, if properly installed, would pay, and pay well, for I had a measure of success at Victoria Road that

was not evident to anyone but myself and those working with me, which success would have appeared greater had I not been handicapped financially during the entire progress of my experiments.

But, gentlemen, today we have a complete plant for the manufacture of peat fuel right here in Canada which in construction, in output, in economy of operation and in cost of permanent installation, so far exceeds my former efforts that I need not take up any of your valuable time discussing history except in so far that which follows may be making history for our successors.

The plant about which I propose to talk is based essentially on the wet machine process in its most advanced form. It is a plant which excavates automatically its own peat from the bog, puts it through a macerating machine and delivers the peat pulp so made on top of the bog in an even layer, cut in rows longitudinally, and also across, making the wet process block, which, before drying is usually about 5x5x10 inches. I propose to refer only to the manufacture of peat fuel up to the stage in which it is laid out upon the ground and dried. We shall have later something unique to offer in regard to the collection of the dried material but for the present we propose to adopt the methods so ably carried out by Mr. Anrep at Alfred.

The plant is rather a new assemblage of proven parts than an entirely new invention, although a number of new and useful devices are incorporated in the complete mill. It is no longer an experiment but it is a demonstrated success and can be seen in daily operation at the plant of the Canada Fertilizer Co., hardly 30 miles from Montreal, and as such is worth your most careful investigation.

The design which made such a mill possible was suggested by two facts: First, that in every wet-process peat plant there is a lot of track laying and shifting or its equivalent in order to get the peat to its drying ground and to keep the plant up to a working face. Second, this could be entirely and successfully done away with by supporting the mill on what we will call travelling aprons, i. e., instead of wheels or broad rollers a supporting device made up of wooden slats in the form of a continuous belt, travelling around parallel axles on properly supporting wheels, the bottom side of this belt being kept right by proper guides.

With these two facts to work upon the first step was to construct a platform large enough to hold the motive power and a peat macerating mill, and strong enough to withstand the shocks of an excavator tearing up large roots or logs, etc., and to make provisions to give the supporting aprons any

desired rate of travel and to make the steering of the device convenient. As it moved along, the next step was naturally to provide the peat, which was done by an entirely new bucket and chain excavator made of steel and sufficiently strong to withstand extra strain, when roots or logs are encountered in the peat.

The use of such an excavator has been made possible because the machine moves freely in any direction and thus can be kept up to a new working face continuously.

The transfer of the dug material from the excavator-discharge to the hopper of the peat mill necessitates a belt conveyor, and with this we have a machine delivering continuously a mass of peat properly prepared for spreading out to dry.

You understand the machine is in motion, therefore the suggestion for the next step was at hand. The machine could be made to spread this peat pulp directly behind itself and so entirely dispense with the so-called separate drying field, avoiding all apparatus and work necessary to spread at some distance from the machine. New devices have been designed for this purpose and for cutting the spread mass longitudinally and also a unique method of cutting the mass crosswise. Now, gentlemen, all that was left to be done was to house the whole suitably and there is your new portable peat mill.

The question naturally arises, "What advantage can we expect from such arrangement of the wet process?" They are too numerous to detail, but chiefly this mill with an output up to 6 tons per hour requires only two men to operate it, namely: an engineer who also steers the device, and the man who makes the fuel, i. e., controls the excavator, the peat mill and the spreading device. This he can do from a seat, which, by the way, we have not yet provided as all controls are by levers situated at one place. Besides these two men we have a boy who drags away the larger roots brought up by the excavator, whose services are necessary only in bogs containing many roots. We dispense with all hand labor to excavate the peat; we need no men to attend to cars; no men to shift or lay tracks, nor to attend to the spreading. Excepting the main ditch which drains the bog and which is economically dug by our peat plant, no cross drains are necessary to prepare any drying field, as the machine necessarily does its own draining and very efficiently at that. The men are not exposed to the weather and can work continuously except in such rain as would injure the peat. On days when a heavy downpour makes work impossible only two men are idle instead of well on to a score. A very level spreading ground is provided as the machine eliminates humps

and hollows by its own weight, transferred to the bog surface through the flat bottoms of the supporting aprons.

Before taking up the machine part by part, there are three things which I wish to point out. First, that I cannot include in a paper that may afterwards be printed and remain on record any of the dimensions in connection with the mill. They may be somewhat different for each individual bog. Secondly, some dimensions of the first machine will be altered in the second, from which still better results are expected, and thirdly, the mill I am talking about has cost us a great deal of sacrifice, time, thought and money, in the face of the contemptuous position of capital, owing to the numberless failures in the Peat Industry. The trying out of this mill has been a peat education in itself, and while to those who are sufficiently interested to examine the mill the fullest information is freely available, it is not my intention to go too closely into details nor to exhibit the detailed drawings of this mill. There are a number of photographs which Mr. Lincoln will gladly show at any time.

The plant from the ground up is divided into 11 parts: (1) supporting aprons, (2) platform and transmission, (3) the motive power, (4) the excavator, (5) the cross conveyor, (6) the peat mill, (7) the spreading box, (8) smoothing service, (9) the longitudinal cutting knives, (10) the cross cutting knives and (11) the housing.

(1) The idea of supporting and moving a peat mill on the same sort of supports as are used in caterpillar traction engines and in ditching and tile laying machines designed to go over sand and soft ground, was first conceived by me in January, 1909. Since then I have spent much time and work looking up the different designs of these caterpillar drives and choosing and altering not only to get a satisfactory design as applied to an automatically moving self-supporting peat mill, but also to get a design which might be protected by patents. There are numbers of unique features in connection with these supports, one of which is an overlapping steel plate arrangement on the slabs of the moving aprons which makes the bottom a smooth, continuous plane and prevents sinking even in the softest ground.

How efficient these aprons are was shown on our first trial when the total weight of our machine was carried over, not only the ordinary surface of the bog, but also over a considerable strip which had been stripped of all surface covering, exposing the soft, sticky peat mud. On the very softest places the mill did not sink over two inches.

(2) The platform was built throughout of the best structural steel carriage made large enough to give room to move

around all the machines and strong enough to withstand the most severe strains from the excavator catching in roots or logs. The driving mechanism includes two speeds forward, a working speed of about one yard per minute and a speed of between two and three miles per hour to be used when turning or when moving about on the working area. The front supporting apron can be turned to steer the machine in any direction. It can be turned in about 30 to 40 feet radius. The steering is accomplished from a hand wheel conveniently situated. A rope spool has been provided by means of which stumps may be pulled. Each individual machine in the plant is controlled by its own friction clutch and these are brought to central points conveniently located.

(3) The motive power we are using at present is gasoline. We have a heavy duty, slow moving, very reliable engine of 36 rated H. P. the best make known. We find this perfectly reliable and convenient; it requires so little attention that the engineer has all the time to attend to the steering. For a single machine on a bog no other power seems so desirable, but for two or three more machines on one property, electricity generated by peat from a Central Station would be preferable.

(4) The unique feature of the excavators which is of the chain and bucket type, supported on a structural steel skeleton, was invented by Mr. Lincoln. It refers particularly to the design of the buckets, which are automatically self-cleaning. The greatest difficulties to be overcome in an automatic excavator for peat is that difficulty encountered from roots and logs buried in the peat and the tendency of the peat to adhere so tightly to any form of bucket that it will not discharge. These two difficulties have been successfully done away with by the new features of the excavator. The excavator is conveniently adapted to make any depth of ditch, and the quantity of peat necessary to keep the mill working harmoniously is easily kept adjusted.

(5) The cross conveyor, as its name indicates, simply provides for carrying the excavated peat from where it is discharged from the excavator to the hopper of the peat mill.

(6) The peat mill is the largest size of Anrep mill, and this type was chosen because experience has shown it to be the most economical and efficient machine for the treatment of peat for the wet process. Only a man who has operated some of the different styles of peat mills can appreciate how all the little troubles, (and I assure you there are many) incidental to the very simple looking operation of macerating and pulp-

ing peat, have been done away with in this machine. Besides this, the machine is comparatively light and very strong.

(7) From the mouth of this peat mill the pulped mass drops into a long narrow box about at the centre. This box is open at the top and has an opening along its rear side from which the peat is delivered in an even layer on the surface of the bog and directly behind the mill. The layer of peat in this box is kept uniform in thickness by right and left hand spiral conveyors, which accomplish their work most satisfactorily.

(8) The peat is now ready for the smoothing device, which has a slight slope downwards and to the rear, and presses down the peat to the desired thickness, and also smoothes the surface of the mass already spread.

(9 Just behind this smoothing device is a row of longitudinal cutting knives which cut the peat mass into parallel strips five inches wide.

(10) Immediately behind this again is the cross cutting device. This is not a reciprocating machine. The knives are supported by a chain moving continuously across the spread area, and so arranged as to make a clean cut every ten inches.

(11) The whole machine is protected by a roof and detachable sides. These sides are left off during the working season, but are quickly put in place, leaving the mill effectively housed and protected through the winter.

The operation of the plant is as follows: The bog is laid out in a rectangular area divided by lines 100 feet apart. The peat mill moves down one of these lines excavating a ditch along this line the required depth to fill the spreading box. The excavator is hung out over the side of the platform and therefore cuts its ditch parallel to the spread peat mass and a short distance away from it.

When the ditch has been dug the full length of the first line, the excavator, spreading box and cutting knives are completely lifted by a lever, and the machine is quickly turned around under its own power and comes back making the ditch twice as wide, and spreading on the other side. This ditch is then left until the peat spread has become fit for fuel, and removed when the machine will come back to it again, doubling the width of the ditch by a cut down one side and up the other, again spreading in a similar manner.

While the peat is drying at the first ditch a second and third, and so on, are cut until a working area has been provided so large that before the plant has reached its far side the peat on the first ditch has been removed and the operation becomes continuous. When the bog is exhausted, or for

any other reason it is desired to move the machine, all that is necessary is to raise the excavator, spreading and cutting devices, put on the sides and travel across country to another property, even over the softest ground if necessary, or, using an inclined platform, the mill may be loaded on a car and so shipped to its destination.

The plant is complete in itself and no other buildings or equipment are necessary.

Although I have spoken at some length, there is much more that might be said as to the behavior of our pioneer machine, its further possibilities and of our plans regarding it, but I have not found time to get this information in shape. Points I have not made clear I will be pleased to take up with anyone interested during the course of our meeting, or to refer to Mr. Lincoln, who can speak authoritatively, as he is in control of all patents pending, in connection with the device, and besides being General Manager of the Canada Fertilizing Co. occupies a like position with regard to the new, and I believe the first Canadian Peat Engineering Company, and who will handle this new mill.

Before closing I desire to again express my appreciation of the knowledge of the manufacture of peat fuel I have obtained from Messrs. Nystrom and Anrep during the time they were working at my plant at Victoria Road, and from Mr. Carlssen, the late Swedish Government Peat Expert, with whom I have been constantly associated for a considerable time, and to the many other workers in Peat who have from time to time given me new ideas or valuable criticism on my own work, and most particularly among these am I indebted to that gentleman who by personal sacrifice has made financially possible that my designs have become real facts, who from his extensive travel both in Europe and in America, and his unusually keen powers of observation, his knowledge of new Peat literature not available to me since it was in foreign languages, and his phenomenal insight into things mechanical, he being of legal profession, in no way connected with engineering, has been able to give me much friendly advice and criticism, besides providing a most successful automatic peat excavator.

Gentlemen, I desire to avoid the appearance of giving myself free advertisement, but I cannot help feeling glad that the experimental step of a new advance in peat fuel manufacturing is over. I have not told you of a proposed machine existing only on paper, nor have I built air castles of what would be possible if we had the money. I have told you of a living body of iron and steel which exists, and which has done all and more than I have claimed.

Gentlemen, I thank you for your attention and before taking my seat I avail myself of the privilege of being authorized to invite you one and all to inspect the machine at work at the plant of the Canada Fertilizer Co., Ltd., near Farnham, Que., **less than 30 miles from Montreal.** (Applause.)

THE CHAIRMAN: This is a very valuable contribution to our literature, and I trust we may see it in print.

The meeting then adjourned for the noon recess.

AFTERNOON.

At two o'clock began what were perhaps the most instructive and delightful experiences of the entire meeting, crowded as this was with good things. Under the guidance of the President of the Society, Dr. Haanel, who was also the active representative of the Dominion Government on the Entertainment Committee, the Members of the Society were taken on an automobile ride about the City of Ottawa, through its fine streets and beautiful park system, to the noble Parliament Buildings and the Dominion Agricultural Experiment Station and Farms, where many things of interest were shown the visitors. These pleasures were preliminary to the visit to the fuel-testing plant of the Dominion Department of Mines, located in a small, business-like brick building in a quiet part of the city.

This is, so far as the writer knows, the only gas-producer power plant, operating wholly on peat fuel, with but a single exception, in Mexico, on the American continent. The equipment of the plant has already been described in another place, but no description can do justice to the feelings of some of the visitors, who for some years had been dreaming of the practical production of power from peat fuel, when first they realized that here their dream was actually embodied in a live, continuously operating plant, that was being run so steadily and at such a low cost per unit of power produced, that it was thoroughly within the range of commercial possibilities; for if the results which were visible could be obtained in a plant so small, at the figures given, it was evident that larger installations of the same type, which would need no great outlay for labor, would be even more economical, and would produce power at a cost per horsepower, that would make a steam boiler plant, burning coal, seem like an expensive luxury in comparison.

All of the visitors gave the plant a very careful inspection and were given every attention and facility by the En-

gineer-in-charge and his assistants, who explained in detail the workings of the gas-producer, the gas-engine, the electric generator and the equipment for testing the efficiency of the plant and for determining the cost of its operation. The time spent here was most profitably spent, and all the party went away deeply impressed at the thorough way in which the tests of peat were being made and many cordial expressions of approval of the plant and of the great value the tests were, not only to the people of Canada, but to all who are interested in cheap fuel, and its utilization to the best advantage, so that all available supplies may be conserved to last as long as possible.

BANQUET AT HOTEL VICTORIA.

In the evening a banquet was tendered to the members of the Society at Hotel Victoria, Aylmer, a beautiful spot some seven or eight miles from the city on the shores of the Ottawa River. The banquet was a most pronounced success in every respect. Mr. J. R. Reid, President of the Board Trade of Ottawa, presided, on his right being President Haanel of the Society and on his left Hon. Sydney Fisher, Minister of Agriculture for the Dominion of Canada.

After the sumptuous repast had been partaken of Mr. Reid said: Ladies and Gentlemen: When I stepped into the position of a member of the reception committee I had not the remotest idea it would carry with it the responsible duty that it does. I have to thank our friend Dr. Haanel for it, fortunately or unfortunately. I am heartily in accord with the remarks made by one of Canada's statesman, Hon. Mr. Sifton, (Applause) when I say that we are very appreciative of the honor conferred on Dr. Haanel by you in re-electing him president of your Society. We also appreciate the fact that you have made the federal capital the place of holding the fourth annual meeting. Ottawa is a convention centre, and of the many important gatherings in this city, having regard to its possibilities, none has abounded with more interest than the gathering of the American Peat Society. (Applause.) If Canadians are anything, they are like our friends on the other side of the line, loyal, and when I propose the first toast I will do it with much feeling for the reason that it is the first time I have had the honor of proposing a toast to our new King since his succession, and when I tell you ladies and gentlemen that we as Canadians believe that a King coming from the stock of Albert the Good and Victoria of revered memory and Edward the Peacemaker, we believe that

he will surely do honor to his illustrious predecessors, and it is with feelings of the deepest loyalty which I am sure you will join in the singing of our national anthem, and it is a significant fact that we will sing it to the same air as "My Country 'Tis of Thee." It is a significant fact that the music of both is the same, and so I ask you to rise to do honor to the toast of His Gracious Majesty the King.

The toast of His Majesty being duly honored, Mr. Reid remarked: Ladies and Gentlemen: The Hon. W. H. Taft is a big man—we all know the significance of that word—he represents a big country, a country with a marvelous history, because I think you will search in vain for a parallel in the history of nations with the same growth in the nineteenth century as that of our neighbors to the south. You commenced the century like us and wound it up with some ninety million souls. I do not wish you to consider that we are blatantly blowing our own horn when we say while we accord this honor to the States that we claim, as far as the twentieth century is concerned, it shall be the century of Canada. Our statistician claims we shall end up the twentieth century with eighty million souls. The prophecy is safe enough because none of us will be here to contradict it, but let me say this that the way immigration is flowing in we are certainly going to be a marvelous country at the end of this century. We have in the Northwest a splendid land, so much of it that if we had your population of ninety million we could give every head of the family 200 acres and have lots left. I am sure you wish us God speed in our national progress. There is nothing but the kindest of feelings between us. We are brothers, born of the Anglo-Saxon blood and with a strong alliance between us, and I want to say to our cousins from the other side of the imaginary line that we are the two great centres of Christianity and that neither the cry of designing politicians nor demagogues shall ever break asunder what the Almighty God has joined together. Although you boast of Old Glory and we of the Union Jack I was going to say that that Old Glory is the broadest ensign that floats to the breeze, but we believe that the Union Jack stands for a little more, but we will not argue that point here. I will say this, Ladies and Gentlemen, that these flags stand for the Christianity of the world (applause) and so as tonight representing the Union Jack I wish to shake hands with the representative of the United States, Colonel Foster, and say we hope to be brothers all. I ask you to rise and drink to the health of the President of the United States of America.

In response to this toast Colonel Foster, United States

Consul, said: Mr. Chairman, Hon. Mr. Fisher, and members and guests of the American Peat Society: On behalf of the President of the United States and on behalf of the nation of which the President is the official head, I thank you most sincerely for the cordiality with which you have honored this toast, and I thank you for the kind and eloquent terms in which you have proposed it. I am very glad indeed to be present here tonight and to meet so many of my fellow countrymen. Their reception at Ottawa I know has been such as to make it superfluous for me to assure them that nowhere in the world can they find more hospitable hosts and a warmer welcome, and no man will find more to enjoy anywhere than in this beautiful Canadian capital. We have been accustomed at the present time to speak of economical problems under many different names, but really they can be grouped nearly under two headings, the conservation and the distribution of wealth. Until very recently public discussion referred chiefly to the question of distribution but we are coming now to realize that conservation, if not the most fundamental, is, at any rate, the first in order. To have any equitable distribution of wealth there must be a wise preservation and a just utilization of the resources of the nation. For the solution of all these problems the conditions are identical on both sides of the international line. The past twenty-five years has been marvelous for industrial development. It will be the attitude of the government in the future to control and to restrain in some respects this enormous accumulation of capital so that it may be the servant rather than the master of the nation. It is the duty of the President to efficiently protect and to wisely administer that natural and undeveloped wealth which is the people's heritage. No one of the policies during Mr. Roosevelt's administration is destined to play any more far-reaching part, or be of more far-reaching value, than the policy of conservation which he emphasized in so striking a manner at the meeting of state governors in 1907 and which Mr. Taft has so recently accentuated and developed. Under such leadership public sentiment in the States has been made actively alive to the importance of this policy. Here in Canada you are encouraged by the Dominion Government, by Dr. Haanel, Hon. Mr. Sifton, and many other statesmen and scientists of the Dominion have taken up this subject with enthusiasm and with a wisdom which promises excellent results in the future. I know of no one who has done more by careful experimentation to secure scientific utilization of natural resources than our friend Dr. Haanel. (Applause.) Through those methods which he has illustrated, such as elec-

tric smelting, the manufacture of peat fuel and many other processes to which he has given his wise direction, he has done much. I regret I was unable to go with you yesterday to Alfred to see the plant there in operation. I am sure all who had the good fortune to go there had a demonstration of the practical utility of the peat bogs of Ontario for fuel purposes. I am a little inclined at this time to take special credit for us Americans in Dr. Haanel, who after serving for years for the Stars and Stripes, we have loaned to Canada for a most important work in time of peace. In this reciprocity of men and of ideas and of knowledge we can develop and should have the fullest free trade as between Canada and the United States. (Applause.) I wish for this meeting and the many meetings to succeed of this Society, much mutual benefit to both our countries. (Hearty applause.)

CHAIRMAN REID: We come now to what I think I may term if I particularize it at all, THE toast of the evening, the American Peat Society. I may make the frank admission to you that while I have given a sort of cursory attention to what has been written and said about the development of peat on this continent, I had not until today paid strict attention or had been impressed to any marked extent with the possibilities of it. I was in attendance at the meetings yesterday and that of last night in which you had excellent addresses by Hon. Mr. Sifton and Dr. Haanel, and I had the privilege of reading over Dr. Haanel's excellent address, and I was never before struck with the importance of publicity to the masses who should be greatly concerned in this industry. We had a note of warning some time ago and it is fresh in our minds on both sides of the line, that is the Pennsylvania coal strike. Eighty million people were placed in a precarious position on that occasion. Experts who are in a position to judge say that in a hundred years the fuel of this continent will be exhausted. That is alarming. If the policy of conservation of what would be otherwise waste products, if it can be developed through this peat organization then it seems to me wise action should be taken, because anything that will safeguard the fuel requirements of the future is in the right direction. Three months ago I passed through Illinois and I asked of a man as a matter of curiosity how much coal was mined in that state and he replied, forty million tons annually. That gives you an idea what a tremendous consumption of coal is going on and the necessity of doing something to make up for the depletion if this is imminent. In the experimentation that is going on through the medium of the American Peat Society, and the same work being done in the direction of developing peat,

seems to me ought to receive the earnest considration and attention of the great public of this continent, and I am pleased that this convention is being held in the federal capital of Canada, so that the citizens of Canada will be awakened to its importance. Dr. Haanel says there are 37,000 square miles of peat bog in Canada. That gives an idea of the possibilities on this side of the line. I am satisfied as a result of this gathering they shall radiate an influence that shall make for the exhilerating of this industry and giving it a great impetus, and I have much pleasure in giving the toast of the American Peat Society, coupled with the names of Prof. Davis, the peat expert of the United States Mines Bureau, and Robert Ranson, of St. Augustine, Florida. (Applause).

PROF. DAVIS: Ladies and Gentlemen, members and guests of the American Peat Society: It was with great reluctance, I may say almost timidity, that I accepted a telegraphic request to respond to this toast, which I received in Washington a moment before I left to come to this city. My mind was filled with The American Peat Society, with the duties I had outlined for myself, with the feeling of pleasure in coming to this territory unknown to me, and to a city of which I had heard much, but of which I had no possibility of appreciating. When asked to respond to this toast I said to myself: "Oh, yes, because I am known to these friends of mine and have been ever since the inception and formation of the Society." But, I did not anticipate any such gathering as is here this evening. I did not realize that I should be obliged to speak to distinguished orators, or to address a large and influential audience. I felt as I sat down here tonight like saying: "What can I say to these people, what have I, who have practically no experience in public speaking and whose business is to go around teaching by word of mouth and by written statements concerning things I wish them to learn, what am I to say to you?" But as I have sat here listening to the eloquence of my distinguished predecessors and meditating on the possibilities of the occasion, it occurred to me that the most obvious thing I could say for the Society was that so long as this Society is in existence, never can we be more thankful as a Society than for this entertainment which the Government and your Board of Trade have tendered us. Never, if we lived a thousand years, will our appreciation of the kindness shown us wane, and I know I express the feelings of the Society when I say this.

I am reminded as I stand here tonight of the first meeting which pioneers in this movement had. The first banquet we had—it was a Dutch treat held in the German Inn at the

Jamestown Exposition at Norfolk, in October, 1907. We gathered there, 15 or 20 of us, sitting around the cafe, and we talked and smoked and ate and drank and had a good time, but never did we anticipate that in three years we would be meeting in this way as the guests of a city and of a nation; it only shows how wonderfully a movement very slight at the outset, can grow, how important it may become, in the course of a short time. I think I may say I was, if not the father, the godfather of the American Peat Society. When I attended to the initial correspondence I did not anticipate being the godfather of so large a family in so short a time. (Applause) .

I have been very much interested in coming to this side of the line to see how Canadians restrict the word "American" to the people of the United States. That is not the right thing, we are all Americans. (Applause). Canadians are just as much Americans as those from the South, and at the time of the christening of this Society it was called The American Peat Society, with a view of including all the people of the American continent, and our name can be used in the broadest sense, especially since some of our most active members are from this side of the line, and surely no society ever had a president who did more for it in one year than Dr. Haanel, our honored president has for this one. (Applause).

It may be of interest to some of the new members and some of our guests who are here, to hear something of the circumstances which led to the formation of this society. It was a simple thing. The United States Government established as a part of the Geological Survey Exhibit at the St. Louis Exposition a fuel testing plant. That proved so instructive and valuable that the exhibit at St. Louis was transferred to the Jamestown exhibition and a liberal appropriation was made by Congress to maintain it. Among the fuel testing appliances was a gas producer—not such a one as that seen today, but a larger and much more cumbersome outfit, in which large quantities of fuel were tested as a matter of instruction to the people and as a continuation of the work done at the St. Louis Exposition. Incidental to this work the Director of the Geological Survey and the Chief of the Technilogical Branch, who had charge of the fuel testing plant, thought it would be an excellent thing if some of the peat deposits which were so available on the coastal plain might be tested, and he appointed me as the man to find the peat and get it for the tests. Carrying out these plans, during the attempts to get the fuel, I began corresponding with our present Secretary, Mr. Bordollo. He and I met at King's Bridge, New York, and, after deciding upon a suitable machine for preparing the

peat, we fell into conversation about the peat resources of the country and it seemed to us that some organization to interest people in the utilization of peat was desirable, and the suggestion was made that we should try and get people already known to be interested, to meet during the exhibition and talk over matters in the hope of forming a society. Mr. Bordollo said he would do the arduous work of corresponding to bring the meeting about. The result was we had the meeting—we saw the peat made ready to test at the Geological Survey plant, and that meeting was the beginning of the American Peat Society, and the two men first there were Mr. Bordollo and myself and, of the two, the former did by far the greater part of the preliminary work. (Applause).

From the outset of our organization, an earnest effort has been made to spread reliable information as to the known possibilities regarding the use of peat—peat as it occurs in the north and in the south. Great possibilities exist in the peat beds of this Continent, and one of the intentions was to disseminate the truth about their value as widely as possible, and to tell what could and what could not be done in a way that would have an effect on the people we hope to benefit. It is undoubtedly true that at least a million dollars has been spent in 15 years in the northern States in peat work that resulted in almost complete failures, owing to unwise attempts to utilize peat beds, or to ignorance and unwise expenditures, and to stop such waste this Society had tried to spread information that could be relied upon.

It is a very difficult matter, however, to make people face facts. One of the things we have been trying to do as a Society is to face the facts—we have succeeded, and although we have had some setbacks we have not been discouraged, and one of the things which pleases me the most is that the old members have been loyal to the Society. It was a hard, uphill fight the first years to keep up the interest, and get the facts on which to base information we sent out, and to get the money with which to do it, but the loyalty of the men who supported the movement was always apparent and has been one of the most encouraging features.

One of the words we hear frequently and which is continental in its significance is "Conservation." What is meant by that? The meaning of it which I like best is wise use—it is the wise use, not the preservation of natural resources. We can best preserve for future generations the natural resources which are part of our endowment, by using them wisely and not wasting them. It has been a custom in America to waste natural resources. More than half the coal in the

ground in the United States has been left in the mines—a great amount has been wasted on the dump and in various other ways, and when we come to consume it, there is a waste of no small percentage of the stored up energy in it by letting the heat go up the chimney and in various ways—as a matter of fact we only use about 5 per cent. of its theoretical energy. What do we do with our peat beds? Because they cannot use the peat easily, sometimes, instead of preserving it, the owners burn it away to get at the sand or gravel below the surface and destroy the stored up organic material in order to get a few more acres to cultivate, but which they cannot cultivate to advantage after the peat has been burned away. The teaching of the proper use of this resource is therefore conservation. It is a great mistake to waste the thing for which immediate use cannot be found. One of the greatest efforts in the work done for conservation in the United States is to teach people to use natural resources wisely. One of the ways of conserving fuel, is by the use of gas-producers. You have seen the excellent one being used under Dr. Haanel's direction. From 20 to 25 per cent. of the theoretical value of the fuel can be converted in such a plant into usable energy. Some steam boiler plants may have an efficiency of 10 per cent. of the theoretical value of the fuel used in them, so the producer gas plant is more than twice as efficient. In a steam plant the energy of the fuel is converted into heat, the heat of the fuel transferred to the water and water converted to steam and it is the expansive force of steam that gives power.

If peat in the gas-producer gives more power than good coal used under the steam boiler, as it surely does, it is evident that utilization of peat in this way is a wide question and an important movement in conservation of other fuels.

The future of the American Peat Society is assured I think from what has been said and done at this meeting. I feel certain that the impetus we have received here and the interest shown by the new members that have come here, that our future is much brighter than could have been foreseen three years ago. We did hope then to make an impression within five years, but it is even now quite apparent and is seemingly very favorable. I think we shall go away from Ottawa, not only with a good impression of the warm hospitality shown us and of the liberality of the people of Capital City and of the Dominion, but, I trust we may also leave behind us one that will be lasting for the benefit of the city and the state. (Warm applause).

MR. ROBERT RANSON of St. Augustine, Florida, then made a few interesting remarks in response to the toast. He said that both his father and mother were British subjects, but that he had gone to the United States where he expected to better his opportunities. "I come from Florida," he said, "I think the farthest that any member has come to this meeting and I do not think that if I walked the whole way to attend it that the time spent in doing so would have been lost. My experience here has been delightful and very profitable in every way."

After dilating briefly upon the possibilities of development of natural resources in the Southern States Mr. Ronson expressed his gratitude for the entertainment accorded him here.

MR. REID: I have referred to what has been done in the interests of the peat industry in Canada but I might emphasize for a moment the work being done under Government supervision, a work largely the outcome of the brain of the expert gentleman at my right, Dr. Haanel. You are aware this work is being carried on under a portfolio minister of our Government. We were fortunate last evening in having an ex-Cabinet minister address us and tonight we have a real one in the person of Hon. Sydney Fisher, Minister of Agriculture. (Applause). It will probably be unnecessary for me to say to you that agriculture is the great backbone of this country and that therefore the minister with the portfolio of Minister of Agriculture probably has the most important position of the Dominion Government. I am pleased that I can associate with this toast the names of Hon. Mr. Fisher and of Dr. McWilliam. These two gentlemen will respond to the Peat Industry in Canada. I want to say in introducing Mr. Fisher that I have followed his record since he has been administering that portfolio and I want to say that Canadians believe that Hon. Mr. Fisher's administration is such as to spell the word "statesmanship." (Applause).

HON. MR. FISHER: Ladies and Gentlemen, our chairman said we were to be through our work before midnight and I will not trespass long on your time and attention. I am asked to respond to the toast of the Canadian Peat Industry. I fear I have been asked to do so because I know so little about peat or the work in connection with that valuable product. Perhaps it is the case of the man behind the gun. We have in Canada a very important gun in the person of Dr. Haanel; the man behind the gun is, perhaps, the Government who has given the opportunity to you gentlemen to hear from Dr. Haanel and have him show you what he has been able to do.

The government of Canada, ever mindful of the industries and resources of the country, and believing we have in this country vast beds of peat which ought to be and can be utilized for the benefit of our people and the world, has given a free hand to its scientific man to see what can be done by the hand of science and the man who guides it. Dr. Haanel is a scientific man who has placed his knowledge and his skill and his industry and intelligence at the service of the people of this country. You are gathered here primarily in the interests of the peat industry, but secondly to examine what has been done in regard to this industry, and it is pleasant to know that the work in this direction has not been lost and that a profit will likely be reaped. We have beds of peat and instead of being a hindrace to developement of our couuntry, it will be an attribute to advancement of the best character.

The chairman has described Ottawa as the city among peat bogs. In olden days when the question of the capital for the Dominion came up and when By-town was chosen it was called a village of the backwoods. I never heard it described as a village of peat bogs, but I am glad that as the backwoods has been disappearing, we have found another source of revenue and supply of fuel. Our toastmaster spoke of the century just passed as a century of the United States and that to come as that of Canada. Without reflecting on our neighbors to the south of us, we might as citizens of the northern portion of America say unfortunately that the century past has been a century of waste, and we hope the one to come will be a century of use and conservation. (Applause). I do not say this because the century past has been the century of the United States. It is true the people of the United States in their greatness and in the magnitude of their work have wasted largely, but we in Canada can cast no stones at you. We, too, in a smaller degree, commensurate with our population, have wasted as far as we have gone, but we feel we owe a debt of gratitude to the people of the States in that the conservation movement in Canada was begun from the invitation of Mr. Roosevelt a little over a year ago to Canada, to take part in the conference of conservation. Hon. Mr. Sifton was one of the delegates and as a result of the conference the parliament of Canada gave to the Government sufficient means to provide a commission for conservation of our natural resources and we were glad to be able to appoint Hon. Mr. Sifton, one of our ablest administrators, and one of our most enterprising and capable business men, to be chairman, and I am glad to know that Mr. Sifton in accepting that place is willing to give his great attainments and powers to that splendid work which

must tell in the interest in the future of our country as it is telling in the interest of the United States.

Welcome has been given to the people from across the border to this country. It is one of the happiest things that we can do, to meet and discuss our common interests and the problems tending to help each other, and aiding in the solution of them. It is an augury of peace, not only in America, but the world over that while one hundred years ago these two nations, the great British Empire of which we are an integral and everlasting part, and the great American people fought out their differences in the old fashioned way by killing each other as much as they could, that here we are engaged in an amicable agreement to solve the differences between the two great empires. They are joined together before an accepted tribunal to solve their differences. I came back the other day from Europe and perhaps the most interesting thing I came in contact with there was when I made a visit to the Hague to see a great tribunal sitting there on a case between the United States and Great Britain, pertaining to fisheries. I saw the tribunal of five men chosen from the world over, listening to the legal arguments from the representatives of those two great people—calmly and quietly solving the difficulty in a small plain hall with only a few people present, but preparing to solve the most intricate international question and ready in a short time to give a judgment, not the judgment of the god of battle, but the judgment of justice and of equality and truth between two of the greatest nations in the world who prefer this mode of settlement to the old-time method of war (Loud applause.) A better lesson in the world's progress cannot be given, and surely if these two great nations can submit their differences to a tribunal of this kind, the other nations of the world should be easily able to submit theirs also. We are trying to conserve our resources—we have many resources of which we know but little. The common people of this country are not scientifically trained, they are rather hasty and are inclined to jump to conclusions without investigation, and I venture to say that there has been more wealth lost and destroyed by reason of our ill-considered enterprises than there has been made by judicious scientific work. It is a hard thing to say—we are a self-sufficient people and a self-confident people, and I speak generally of the two peoples, of the people of the whole continent of America—enterprising and ready to go into anything, and the result has been that we have wasted enormously our energies and possessions of wealth. It is time we woke up to the fact that we need science as the handmaid of our industry, that we need the men who study these problems to help

us in our work. Dr. Haanel and others are doing that today in this peat industry. I know, myself, in the last 25 years there has been perhaps over a million dollars wasted in the peat bogs of Canada, with no result except the recognition of failure. We trust and believe that they, with the handmaid of science, are going to solve the questions and make use of this great treasure that has been lying in our midst. If this can be done a great good will be done to the whole people. We have been wasting our coal, our woods are disappearing on this continent, and if we can find a substitute for them, one of the most difficult problems facing us will be solved. I myself believe in the sure progress of the human race and the sure provision of Providence of our needs, and if in a hundred years the supply of coal is exhausted I am satisfied we will have something else supplied in place of it. We sometimes discuss the pulpwood industry and we think of the enormous utilization of pulp in the manufacture of paper, and calculations have been made that in a few years there will be no more black spruce or other woods used today in our great paper industries, and the continent will be at its wits' end for a supply of paper. It is only the other day in London I was talking to a gentleman who said he had clearly proved the efficiency of a certain plant that grows in certain climates and so luxuriously that a large supply of good pulp could be obtained, larger than all the woods of America could supply. I do not know the truth of this, but I have no doubt that in a short time there will be a substitute for wood pulp for paper manufacture. I do not say this to encourage the destruction of our forests, for even if not used for the manufacture of pulp we would need them for various purposes, if for nothing else than for the moisture necessary for the cultivation of our soil. I wish to say, before sitting down, on behalf of the people of Canada, that we welcome you to Canada and we hope that you will enjoy yourselves. If our hospitality is enjoyed it is because it comes from the heart of the people who understand you. We are glad to discuss with you and learn from you; we say if you come and stay with us, as so many of your compatriots are doing today, we will welcome you with open arms. We are glad to find that while we have supplied you with many of your most successful and enterprising pioneers in the early days of your own development—for there are over two and a half millions of our citizens under Old Glory—that today you can afford to send us back a few hundred thousands of your choicest citizens. We welcome them and assure them an opportunity of livelihood under the flag of old England of which we are so proud. This means a tie between the two countries—fellow-citizens in both countries, and one of

the best pledges that we will live together in friendship and will only indulge in friendly rivalry for the common good of our countries. I thank you for this opportunity, which is perhaps out of my line as Minister of Agriculture, but still comes closely under the responsibility of the Government. (Loud applause.)

DR. McWILLIAM said: Ladies and Gentlemen: I have altogether too much regard for your health to keep you here at this late hour and besides, I have very much diffidence in talking after the distinguished gentlemen you have heard. I have to thank you very much for thinking of me in connection with this toast. I will cut my subject short by just referring to one feature. I have been since the beginning of this Society a member representing the Dominion of Canada, and have looked forward to the time when the American Peat Society would visit Canada. I looked forward to it with fear and trembling, and if affords me special gratification to be present tonight and to look back upon the experience of the last few days, and as a member of the American Peat Society to express my extreme gratitude at the manner in which Dr. Haanel and his associates have provided this entertainment for the instruction and pleasure of the members of the society. As a Canadian I feel proud of ourselves, as a prime mover in getting the association to come to Canada I am extremely gratified with the outcome of this meeting. We of the American Peat Society have been leaning almost entirely upon the shoulders of Professor Davis. I am proud to add that we now have another gentleman closely associated in the work in the person of Dr. Haanel, who adds learning, lustre and knowledge to the Society. It gives us courage to feel that we are not pursuing the will-o'-the-wisp when associated with men of their learning, culture and expereince. Therefore I am extremely gratified that we have been able to sociably entertain our friends. There is another point—we have been able to show our American friends who honored us with their visit, something that their country cannot show in the progress made in the handling of peat. It is surprising to say that the Canadian peat industry today consists almost entirely of the effort made at the bog at Alfred, together with the practical utilization of the material we are producing there, and in the gas-producer and engine in Ottawa. This is a practical illustration of what can be done with peat. I did not dream of this three years ago, and it is a proud moment to know that the Peat Society had to come to Ottawa to see the culmination of the work going on during some years.

A small hole about four feet deep and the remains of some machinery mark the first attempt to utilize peat in Can-

ada some 40 years ago. It was in the north part of London, Ontario, and $25,000 are buried in that hole. Happily, out of that effort failure did not come to those people, for those who began there followed on in the gas-making business and are today the wealthiest people in London. At Stratford $53,000 was lost; at Welland, $243,000, and at Perth between $40,000 and $50,000, and at Beaverton another $50,000. So the history of peat in Canada is a long one of failure. Today there are only three of us making any effort to produce peat—and the plant at Alfred. That is the position of the peat industry in Canada. If our meeting had been two months later we would have been able to give a practical report from our efforts near London. The peat industry is a matter of the future.

I did intend to speak of the formation of a Canadian Peat Society, but I will not do so now and will close by expressing the hope that our friends will go home with feelings of pleasure for the entertainment given and feelings of gratitude for witnessing the culmination and fulfillment of endeavors in the development of peat, and feeling that one more tie has been formed between the two nations which rule this continent. (Applause.)

THE CHAIRMAN: We had at our meeting today Mr. Kidd, M. P., of Carleton, and tonight we have Mr. Thorburn, another member of Parliament, with us, all going to manifest a growing interest in our cause.

MR. OWENS, of Chicago: I want to propose, in regard to the cordiality expressed by the gentlemen, that we drink the toast to the Canadian representative at Washington and to the United States representative at Ottawa, hoping that this cordial feeling will ever continue to exist, and that when at the border line we shall extend our hands and say "Hello, Peat."

This remark of Mr. Owens' enlisted an outburst of applause and established the slogan between the members of "Hello, Peat."

During the evening humorous recitations were given by Mr. Gordon Rogers and Mr. Ab. Heney, and excellent vocal selections by Mr. Jack Clarke, the three being Ottawa's leading artists in their respective lines.

The dinner was then brought to a close and the party returned to Ottawa by special car.

WEDNESDAY, JULY 27, 1910.

Morning Session.

PROF. DAVIS: May I say a word before the papers begin? Dr. Haanel has had a tremendous amount of detail to attend to in providing for our entertainment, and I want to express regret that he is still under the weather and not able to be present, and also to say that he asked me to tell you he was deeply gratified and touched by his re-election as President and to assure you that he was very grateful, and will do all in his power to continue the work that he has been doing the past year; also that he would assure us of co-operation in the work that the Society might undertake, and he hopes that we will not lose the interest that we now have before the next meeting. That means that every man here must do what he can for the advancement of the Society's interest and not leave two or three officers to do the work. You must realize that is it a complimentary thing to have men of more than national reputation talking to us—to have Hon. Mr. Sifton come from his summer home and take the time to prepare a paper such as he read the other evening. It is something that we should feel proud of. The resting time of such a public man is worth a good deal to him, and if based on the time spent in preparing the address, it must be a very valuable address that we will have for the columns of the Journal. It shows the interest of representative men in the movement, and we ought to put some personality into the thing ourselves.

DR. McWILLIAM (presiding): Without following the order of the program, we will take up the papers as ready. We will now hear from Mr. Robert Ranson, of St. Augustine, Fla., on

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PEAT AS A FERTILIZER AND SOME METHODS OF DRYING AND PREPARING IT.

Gentlemen: I know of no meeting that could give me greater pleasure than the one I am privileged on this occasion to attend. Ever since our last convention in Boston we have awaited the coming of today with keen expectancy, asking ourselves, Who shall we meet? What shall we learn? Have we progressed or retrograded? Is it worth while?

These and other questions have tortured me to such an extent that to thoroughly satisfy myself, I have traveled 1,800 miles, more or less, in the hope of learning something that may profit me or the Section that I represent, and in exchange to offer you, gentlemen, a quid pro quo from my own experience.

To refresh the memory of those I had the pleasure of addressing last year, and to inform those who were spared that infliction, I will state that, after a close study of the subject before us for the past 12 years in the South, and reading reports from almost every section of the North American continent, I have come to the conclusion that Florida has a larger acreage of peat bogs in proportion to her area than any other State or section; briefly, about 10,000 to 12,000 square miles. Further, many sluggish rivers flow over and through beds of decayed vegetable matter of such great depth and area as to not only insure inexhaustible supplies of this great product of nature for all time to come, but to cause us to regret that our calculus is too limited to properly express these vast quantities in intelligible terms.

This is particularly worthy of notice, in rebuttal of the testimony of our average encyclopedias, which state broadly that in tropical and semi-tropical countries, decay of vegetation is so rapid as to prevent the formation of peat, thus plainly indicating that the learned author of these useful books of general information had allowed himself to lay down rules for Nature to follow, which she had for centuries previously persistently ignored.

Thus, though the highlands of Florida is a poor, sandy country needing large quantities of fertilizer, we have stored up in our bogs, marshes and rivers, such vast bodies of decayed vegetable matter, humus rich in nitrogen, as not only to make Florida independent of this expensive element from outside sources, but to place her in a position to supply her neighbors indefinitely. Little as it may now be recognized or admitted, this nitrogen is a mine of wealth which, when developed in the near future, will be so great that beside it, the present phosphate production of Florida, though very large, will look small and insignificant.

When actual analyses show in many cases a content of 3 per cent., or 60 pounds, of ammonia to each ton of properly prepared peat filler, and when for each acre excavated, as I am now doing to a depth of about 15 feet, we have 3,000 tons of dried filler containing 180,000 pounds of ammonia, valued at 16 cents a pound, we stand confronted with the fact that our formerly worthless acre of black mud is convertible into a value of $29,000, at a cost of less than $5,000.

In view of these figures, it is not difficult to see in these days of money grubbing why I turned my attention to the possibilities of peat as a fertilizer in preference to fuel, in a country where we have a great need for the former and but little for the latter. The large bulk of desirable peat in Florida lies so low

in the water that the only practical method of excavating is with a dredge, and two that I have built for that purpose, at a cost of about $3,500 each, and which cost about $10 a day to run, will excavate sufficient wet peat to furnish up to about 75 tons of dry filler daily.

This wet material, containing about 85 per cent. moisture, is carried on a lighter to a long dock onto which it is mechanically unloaded from the lighter in a large heap. Down the center of this dock, 25 feet in width and 125 feet long, runs an endless belt 16 inches wide, and onto this the wet peat is shoveled by hand. This takes it to a 10-foot pug mill, such as is used in brick works to pug clay. In this the peat is thoroughly macerated and converted into a homogeneous mass. From the end of this pug mill it passes to a second conveyor belt, about 60 feet long, which deposits it on the ground in a large heap, at a good distance from the mill. From this point as a center it is spread out radially, about eight inches thick, over a half circle of 300 feet. This is accomplished by a spreader constructed as follows: On an axle about 10 feet long, with common wagon wheels at each end, hangs a board on hinges, about 8 inches clear from the ground. This is drawn backward and forward with wire ropes for 300 feet by a small hoisting engine. As soon as one section has been spread the whole 300 feet, the engine is moved along on a track 25 feet and a second line spread, and so on until the entire half circle is covered about eight inches thick. In ordinary weather this sheet commences to crack lengthwise in about two days, and crosswise in two days more, so that the whole spreading assumes the appearance of a large plate of broken fudge.

In ordinary weather, material originally spread eight to ten inches thick dries in a week to 40 per cent. moisture, and in two weeks to 25 per cent. It is then removed in small carts to a large heap, which should be under a light cover, to be stored till wanted for final grinding and drying.

I have tried several methods of grinding, and though they have worked fairly satisfactorily, I still see possibility of some slight improvements in this line, and at the first opportunity I shall try such a wood grinder or hog is is used to grind up slabs, etc., for fuel in our large saw mills. My aim is to get the peat ready for the final drying by sun and air-drying to as low as 40 per cent. moisture. The finished product called for by the fertilizer factories is dried down to 10 per cent. of actual dryness.

This brings me to the central fact of the whole peat business, as practical men well know, "the drying problem." It is natural, living as I do in a country which has an annual rainfall

of about 55 inches and an average of 320 clear days in the year, and with a sun, which you well know, in the 30th degree of latitude, is no ways modest about singeing hot, that I should lay great stress on sun and air-drying and depend on these natural sources of heat to the fullest extent possible.

Naturally, in these days of rapid processes and demand for immediate results, it seems old fashioned to do anything by depending on the elements alone, but when we know by acutal results that for the units of moisture extracted by the sun in his quiet, gentle and persuasive way, we have been saved a good many dollars' worth of coal in a day, we begin to find that it pays us to make careful figures to find the relative balance between the cost of fuel and the cost of time and labor in spreading, drying and storing, instead of taking the material wet from the bog and putting it through a heated mechanical drier to its final process at once.

Why peat should be so retentive of its moisture is something I have yet to study out, or to hear explained in any common terms. I sometimes think that the peat and the water, which are about the same specific gravity in our bogs, have been so long together that they hate to part company, or that certain elements are present which have made an emulsion of the peat and water.

At any rate, we must admit the existence of a mechanical mixture quite unusual in any other material simply mixed with water. I know of no practical peat man today who takes any stock in forcing the water out of peat by mechanical pressure, a process so often recommended by new beginners in the business. It is a fact that after wet peat has been heated for some time to the boiling point of water, considerable water can then be pressed out, much more than before heating, but this belongs to the realm of experiment which I am not now considering. After careful study and actual experiment at different times and in different locations I have come to the cosclusion that where the spreading process, such as I have described, and for which I have applied for a patent, is used, we can house in a reasonable time a product ready for final grinding and drying, dried to about 40 per cent. average moisture, at a cost of 75 cents a ton.

At this point of its manufacture is it in excellent shape for fuel, as shown by the samples I have on exhibition. In putting the cost of this material at 75 cents a ton, you will understand that I am figuring on the services of about eight trained men with one mule and cart, but in first starting this work, as in any factory with a lot of inexperienced men, very poor results are often shown.

The next process and the most important of all is to dry the peat to its final shipping condition. This must be done by artificial heat, and if the proper machinery is used, it can be done cheaply, effectively and quickly. In drying peat containing originally 85 to 90 per cent moisture, down to 10 per cent., it might naturally be expected that whatever process was used, the first moisture extracted might require more heat or more time than the last. It thus becomes a question with the manufacturer who has to dispose of say 75 per cent. of moisture, or 6,000 pounds of water for each ton of finished material, to decide the cheapest and best of the only two practical methods offered him, i. e., sun heat or drier heat, and if both are used, as in my plan, when to apply them. Giving the benefit of my experience up to date, I would say that the first 50 per cent. of the moisture to be extracted is the most difficult to get rid of, and thus I turn over this unwelcome job to the sun, with excellent results; the last I effect with artificial heat. I am informed, however, that some parties are expecting to reverse this process, and take the wet material from the bog, dry it in a rotary drier from 85 per cent. to 40 per cent. moisture, and later dry it to 10 per cent, by exposure to sun and air. Whether this is practical or not, I am not prepared to say, although I rather doubt it; yet my past experience with peat manufacture makes me slow to condemn methods until I have thoroughly proved them wrong.

We have now arrived at a point, the most important in the planning and erection of a filler plant, the choice of drier, an apparatus in which we can, to the very best advantage, apply artificial heat to the problem in hand.

Until recently I have had no hesitation in saying that the driers used for this purpose have been the crudest devices possible. For the most part those in use are simply single iron tubes, revolving on wheels or trunions, averaging about 40 feet in length and about 60 inches in diameter. One end of this tube, or drier, is open to the flames of a furnace and the other terminates in a brick dust room, and the wet material is fed through a chute above the furnace, and on account of the incline of the drier it passes slowly down towards the lower end, usually taking from 15 to 30 minutes to make the passage. When working, the drier shell is red hot for its first 15 feet, and the loss of heat by radiation is of course great. The material which is fed in, although of various degrees of moisture, comes out at the rear end dried down to the point desired by the purchasers and is then screened and sent to storage hoppers to await shipment. It takes considerable practice on the part of those in charge of the process to so nicely adjust the amount

of material fed in and to so govern the fires as to insure a finished product neither too wet nor too dry, nor charred by an excess of heat.

I started operations with one of these single-tube driers, but found it not only wasteful of fuel, but extremely dangerous in a building where there is any wood exposed, and I think by this time about every peat filler factory has burned down, at least once, from excessive heating of the drier. Knowing all of the objections to the use of a single-tube drier, especially its high consumption of coal, I looked round for some improvement in this line of machinery and finally found the double or return-tube drier made by the Ruggles-Coles Engineering Company, of 50 Church street, New York.

As I have been asked to speak especially on these lines, and to give my experience with different driers, I gladly do so. In the double-shell drier mentioned, the drying is effected by heated air, and at no part of the drying does the fire come in contact with the material to be dried. The benefit of this is twofold: first, the danger of charring is reduced to the minimum, and second, the heat-giving flame runs its whole course of combustion and is not extinguished by impinging on the wet, cold material, which acts as a blanket on the flame. In the single-tube drier from 8 per cent. to 10 per cent. of the fuel value is thus lost in the form of unconsumed carbon, while tests in the double-tube drier show that the long central flue acts as a combustion chamber and the loss from this source is less than one per cent.

In theory we know that a certain amount of heat must be expended to evaporate a certain amount of water, and where this heat must be provided by artificial means, the problem before us is to use every unit of it and waste as little as possible. Perhaps the two best tests to prove the advantage of the double tubed drier over the single tube, in respect of economy of heat, are, first, to note that when running it is possible to hold the hand on the outer shell of the double-tube drier for almost its whole length, without being burned, while the first 15 feet of the single drier, when at work, is always red hot and the rest of it not much less; and the second, to state that in the single tubes the flame and heated air travel but the length of the drier, 40 feet more or less, while in the double tube they travel just twice the distance, emerging from the suction fan with almost all their heat gone. Outside of the economy resultant from a complete using of the coal-generated heat and small loss by radiation, the next most important item is the mechanical construction and general setting up of a drier.

In heating an iron tube 40 feet long, there is considerable

expansion, and in all of the single-tube driers I have seen, this causes trouble and often necessitates shutting down the machine because the expansion of the single shell makes it bind at the furnace end. I never remember to have run my single-shell drier over an hour without shutting down for some cause or other. I have frequently run the double-shell drier for 10 hours uninterruptedly and have seen a record of one that ran 12 months without stopping day or night. The reasons for this are two fold: first, the expansion is compensated by a telescopic arrangement of the center tube, with the flue, through which the flame passes into the drier; and secondly, the expansion and contraction of the inner tube is absorbed by a system of hanging stays, preventing all undue strains in changing from the lowest to the highest temperatures. The first cost of the double-tube drier is about double that of the single. Its life is easily four times that of the latter, the mechanical construction much more substantial and true, and the economy of fuel very great.

Thus, in summing up results, with no disposition to tire you with figures, I feel it only due to substantiate results by a small table here appended from which the annual saving in fuel and increased production of filler can readily be deduced:

Per cent. Moisture	Coal used, Single-shell	Tons per hr., Single-shell	Coal used, Double-shell	Tons per hr., Double-shell
80%	1306	0.41	871	0.63
40%	222	2.05	148	3.06
30%	146	3.07	97	5.06

With these figures before us as a basis, we have two main points illustrated: first, the great advantage of taking out the first 40 per cent. initial moisture by sun power; and second, the advantage in economy and output of the double-tube over the single-tube drier. Leaving the further consideration of this part of my subject to those specially interested, to whom I shall be glad to give any advice or information further required on this point, I desire before conclusion to state that now, more than ever before, the various chemists and soil experts of the different State Agricultural Experiment Stations are awakening to the value of humus in its many forms as a soil constituent and the fertilizing value of the nitrogen contained in peat. I note in all the analyses of European peat, that the nitrogen, or ammonia, content runs but little over half of what it does in this country, and where the state of decay, etc., is about equal, I find the northern peat slightly richer in nitrogen than in the south.

Peat filler is sold on the unit basis generally, and at about $2.00 to $2.25 per ton per unit of nitrogen. This would make the value of filler with 3 per cent. nitrogen $6.00 to $6.75 per ton.

This is, in my opinion, far below its real value to the farmer. I can see no reason why the nitrogen should not be valued in proportion to present wholesale prices of ammonia, say 16 cents a pound, which on a basis of 3 per cent. equalling 60 lbs. per ton, would give us 60 lbs. x 16, equals $9.60 per ton. We then have left 1940 lbs. of humus of which, in my material, 75 per cent. is soluble, which certainly must have a much greater value as a filler than the ordinary make-weight fillers now used, such as low-grade acid phosphate, ground slag, slack coal, sand or graphite, most of which have no manurial value and are in many cases absolutely detrimental to the soil.

The statement is often rehearsed that not quite half of the total nitrogen content of peat is immediately available for crops, which is true, but when we have numerous proofs that the remaining half is potential, and is eventually absorbed by plants, it seems to me that this should in no way impair its present or ultimate value. We have hundreds of thousands of acres in the United States that today are desert from lack of humus and exhausted beyond the power of recuperation by commercial fertilizers.

I can imagine no greater mission of good to the human race today than confronts us peat men in the preparation of this material and its proper application to our soils.

A vast field is opened to us in combination with gas production to save the resultant ammoniacal liquor and to concentrate and crystalize it for fertilization purposes.

If there exists today any cheaper source of this most expensive element of fertilization, I should be glad to be informed of it. I am hoping in the coming year to demonstrate these matters on a larger scale than ever before and with a proper investment, work out greater economies and quantities than hitherto attempted. It certainly must be apparent to those of you, who have devoted so much time and energy to the fuel end of the peat question, that you cannot apply it for the production of power to greater advantage than by gasifying it and whilst so doing, do not forget that probably the poorest of your peat will contain at least twice the ammonia of coal, its present main source, and make every effort to save it for agricultural and other uses. If, in the past, any money has been made out of peat production in any form, it is what has been prepared and sold for agricultural fertilizers. Great secrecy has been the rule among manufacturers and I am satisfied that this policy has hindered the development and demand for these

products far more than any advantage that has accrued to the holders of supposed secrets in its manufacture. I have travelled several thousand miles to visit rival plants and spent hundreds of dollars to do it, when by a cheap system of correspondence this might have been largely sufficient. I believe in the open door as conducive to our success and shall ever advocate the same.

We must rally round the men appointed by Uncle Sam as our leaders and who we know by experience to be reliable and trustworthy. We must boost our little magazine by special effort and subscription, so that we can depend on getting it out each time without delay and subsidize it liberally for our mutual benefit. Each grain of help thus given will rebound to our great advantage financially, and above all help along the greatest of all world movements,—to increase the fertility of the soils and by the magic touch of the wands of experience, knowledge and experiment, do our share towards lightening the burdens of those who toil for the altogether indispensable, our daily bread.

MR. CRAIG: You allude to the value of the humus in the peat—is not humus destroyed according to the fineness to which you grind the peat?

MR. RANSON: No, it is made still more valuable. The finer we can grind it the more readily the plants absorb it as plant food. That has been the trouble in the past—our farmers would pile big lumps on the orange groves and the soil would not get the benefit the same as if we put it in powdered form on our sandy soil. I do not see why grinding it fine would reduce its value as a humus.

MR. CRAIG: I understood that the property of humus was to keep the soil open and prevent it from compacting together.

MR. RANSON: Well, I think it does. Anyway the demand has come to us to grind it as fine as we possibly can and the Agricultural Experiment Station at Amherst, Massachussets, prefers it that way, because grinding it finer makes it more valuable. Formerly we had a 12 mesh screen with little more than a twelfth of an inch and then they got me to use a 10 mesh screen and now I am going to do away with the mesh and grind it still finer with the wheel.

MR. LINCOLN: I know of one plant drying in a single shell which took 9 tons of coal to dry 5 tons of peat. No wonder they failed. If it costs 75 cents to lay the peat down

in your shed how much do you estimate it costs to bring it down 30 per cent moisture for shipment?

MR. RANSON: $1.25. $2 finished in the shed and while in this shape 75 cents.

MR. LINCOLN: That is $2.30 for the finished product? The company mentioned was paying 95 cents for coal and had an output of 2 carloads in 3 days and was getting $3.50 per ton. The Springfield Filler Co. was delivering to St. Louis and they never got more than $4 per ton. If you take into consideration the freight, as I heard, from Chicago to the Southern States, $5.50, the consumer can buy your material cheaper than in Chicago by $3.

MR. RANSON: If I could not sell it for $6 a ton I would quit making it. There are two things to the business, the making end of it and the selling end of it, and the latter takes more time than does the making. I found there was a general desire to get hold of it among fertilizer men if they could. I went to one who used 600 tons a year and asked for a contract to supply all he wanted. He asked: "What price?" and I said, "$6 a ton," and he said, "All right." We were delayed and I got him interested in the company and got a contract for $8 a ton, instead of $6. It had been costing them $11.50 a ton. As long as they can use graphite and sand and any other old stuff and get the farmer to buy it, all they will give us credit for in this material is the ammonia in it. With three per cent ammonia they will give as much for it as where the filling was vegetable matter. It is up to us to educate the farmers to that point where they will demand of the fertilizer makers this humus as a filler, and when they do that we will get what it is worth.

PROF. DAVIS: I have been asking filler people what it costs to get the filler out and I have found it hard work to make them confront the facts. One superintendent says he cannot get any peat except it is piled up wet. I asked what difference it made whether he got a small pile of nearly dry stock or a large wet pile, which, when dry, would yield the same or less? He said he could not make his men see that it made no difference and he had to get the filler anyway. It goes that way. Another superintendent said, "We cannot dig the peat one day, leave it to dry and throw it into the cars a week or two later—it is too much work." I said, "Don't you think it would be easier to throw it on the cars and that the drying it would get would pay you?" But no, he could not see it—it would be a change in the method he had adopted.

The outside bosses of the digging gangs are running the

filler business and the managers or superintendents are not, even if they handle the checks, pay for coal and try to see how to pay a profit. If trained men directed the work, there would be no difficulty about the profit. But as long as it requires a ton of coal to produce a ton of finished material there will not be much profit. It is hard to convince the trade of this fact.

There is an important phase of this matter that Mr. Craig and Mr. Ranson suggest, namely: that of the effects of humus material on the soil— that is very varying—there are a dozen things which the organic matter of the peat does to the soil —it does lighten it, but apart from that it tends to make sandy soil more fertile because it introduces fine material, but aside from this the peat itself helps to keep the soil moist. There is another property of the material; in the soil it affords nourishment for the bacteria and other organisms which are essential to the fertility of the soil. In that way it is an advantage to use this substance.

MR. CRAIG: Mr. Ranson brings to my mind a statement made by a friend of mine, that a chemist is cultivating bacteria for the generation of nitrogen, and it was claimed that peat is the natural food material of these bacteria and after they got a bag of peat perfectly saturated with that bacteria they sold it at so much a bag—can you give us any information on that subject?

MR. RANSON: That is very possible but just to what extent practical it is somewhat hard to say. It is a matter of that inoculated humus following along the process of decomposition. The black peats are nearer humus than brown peats, and are better material for the bacteria to grow in than the brown peat. I have no material to present of my own development but I have no doubt it is possible to start the culture of bacteria in humified peat properly prepared, and benefit the soil by using that inoculated material as a fertilizer. There have been several substances used to get it in this way. The theory is all right but how it will work out practically is very problematical. It seems to be a commercial proposition if carried on on a large scale. It has not yet been so. The plans have been worked out and I think only the lack of capital has made it impossible to complete them—it is described in one of the bulletins in the Canadian Survey.

MR. WALLACE: How many tons of finished product will our six double cylinder driers turn out in reducing from 80 to 40 per cent water and from 40 to 10 per cent?

MR. RANSON: That involves a considerable scale of figures, but if you write the manufacturers of the driers they will give you the figures from 1 to 95 per cent showing the exact number of pounds of moisture to be extracted for every ton of material, and the number of tons of coal required in single and double driers. Ask them for a table of moisture and you will find it.

A MEMBER: What grade of coal did you use?

MR. RANSON: I used wood until I got started and then peat. I have a grade of wood that is equal to coal because it is full of pitch.

A MEMBER: What is the output of one of those driers?

MR. RANSON: About 3 tons an hour or 30 tons a day. It sometimes goes a little higher in moisture and sometimes lower.

PROF. DAVIS: I have been making some investigation into the cost in fuel or heat units for reducing the peat from 80 per cent water to 40 per cent—I assumed that the plant would produce 50 tons of dry material in a day, and I found that it would take 11.9 tons of coal to dry out 50 tons of salable matter. To reduce from 80 to 40 per cent, this means that nearly 24 tons of coal would be needed to produce the 50 tons of material with driers of ordinary efficiency. When one remembers that immense quantity of water and the big volume of coal one has to use compared to the volume of material produced to sell, it does away with much of the misconception with regard to the feasibility of artificial drying material that has to be sold at such a low price as any product must be that is made from peat. If sold at a price which would give a good profit it would be different, but here you are dealing with a substance for which $3 a ton is a good fair price, as the markets run.

THE CHAIRMAN: When you bring the moisture in peat from 90 per cent down to 40 per cent there are only 133.3 pounds of water and 200 pounds of peat left and when 30 per cent we only have 87.5 pounds of water and 200 pounds of peat. If we can dry the material on the ground from 80 to 40 per cent moisture we reduce the quantity of water from 1600 pounds to 267 pounds to the ton. There is something enormous the increase in weight of water in peat as the percentage goes up.

DRYING PEAT.

THE CHAIRMAN: I was down for a paper on the drying of peat. As the whole peat world is absorbed in the question of briquetting peat I thought it would be interesting to make a few remarks along that line. Just now while in the chair I wish to express the satisfaction of the American Peat Society for the press notices given these meetings, for the splendid reports in the three papers during the past three days. Might I offer a suggestion to the newspapers—we look upon them as our masters and are somewhat afraid to suggest anything to them, but might I suggest one mistake which was made yesterday—they said our meeting was not largely attended. This was a mistake. This meeting and that of yesterday are largely attended. This is not an entertainment or a meeting of business men who are trying to get ways and means to raise the price of a product. This is more of a scientific meeting and if you attended the meeting of the British Association for the Advancement of Science you would think our meeting very largely attended. Members have come here from a long distance and have heard many practical suggestions. Our work is in a new field on this continent and to my mind our meetings are exceedingly well attended, considering all of the facts.

Relative to the topic assigned me, some will bear me out in saying I ought to know as much as any man about handling driers. I wish to say that Mr. Ranson's idea is the best I ever heard of. Getting out the first 50 per cent was the easy thing with us, but it was reducing the moisture from 30 to 15 per cent that sticks us. If this double tube drier will do a quarter, or even one-tenth of what he says, the whole problem is settled. If with one pound of coal we can get one ton down to 10 per cent of moisture the whole thing is almost solved. We pick up this peat at 25 per cent moisture and we think we can place that in our bins at 25 cents a ton. I just want to compliment Mr. Ranson—he has made the best advocate of any man I have ever heard. Of course this is interesting to men using the peat for fertilizer, and of course here in Canada our land is so rich we do not require that. I do not think it worth my while to think of it, but as a briquetting man, that is most interesting, and as a man following up fertilizing I think it is the most valuable paper we have heard in four years, and we must feel very grateful to Mr. Ranson for it.

PROGRESS OF PEAT BRIQUETTING.

THE CHAIRMAN: We have a paper here by Mr. O. E. Moulton, of Dover, New Hampshire, entitled "The Progress of Peat Briquetting," which I am sure will interest you. It is as follows:

Mr. President and Gentlemen:

The subject of the briquetting of peat, unlike that of medicine or religion, presents no inexhaustible aspects to the student. In approaching the subject for the third time, for the purpose of presenting some thoughts for the entertainment, if not for the instruction of the members of this Society, the writer desires to bespeak the indulgence of the "Old Timers" present, if, perchance, they should detect either a repetition of former expressions or an attempt to present old ideas in new clothing.

At the very threshold of investigation, one is confronted with the extreme paucity of data, or, at least, of data not already pre-empted, and is forcibly reminded that for an audience he must look among that class of hearers not yet fully conversant with the general subject of peat fuel manufacture.

The history of peat briquetting is contemporary with that of peat fuel manufacture in any form, even though it seems to have lagged so far behind in the procession as to be almost lost from sight, especially among the people of foreign lands. Not so, however, with peat's elder brother, lignite or brown coal.

It may, perhaps, be well to begin the investigation of our subject by consideration of some of the facts relating to this hitherto neglected and much despised fuel material, known as lignite or brown coal, from which, according to Mr. Mason, the United States Consul to Germany, in 1903, there was being manufactured in that country, no less than 44,000,000 tons of briquettes every year, the product of 236 factories, in which were installed 691 presses, each having a capacity of 70 tons per day.

Brown coal is found in quantity in most of the Gulf states, in not a few of the middle western states, among which are Missouri, Iowa, Indiana; while in Alabama are large deposits of the best quality known in the world. Again, according to the newspaper reports of the time, the people of North and South Dakota and Montana, burned corn, their fences, their outbuildings, anything in fact, to prevent freezing, during that winter of 1902. Yet, but a few feet below the surface, in those three states alone, lie from 20 to 80 feet of excellent lignite, covering an area of 55,000 square miles. Think

of it, gentlemen; a people suffering for fuel, with 35,200,000 acres of lignite at their very doors, with an average thickness of 50 feet, a fuel, that, when properly prepared, is superior to most of the soft coals. Unfortunately, however, lignite, as taken from the ground, is but a poor fuel, the water content ranging from 30 to 50 per cent, being just enough to prevent its lighting readily, while insufficient to facilitate the drying into hard cakes, as peat will do when cut and stacked in the sun.

The remedy for this, as our German friends have taught us, is grinding, artificial drying, and briquetting, resulting in a clean, smokeless, most desirable fuel, which burns with a long flame, will not clinker, and which, as in the case of the Alabama lignite leaves but 4 per cent of ash.

This method of manufacturing fuel has, as we have already noticed, grown to large proportions in Germany. Mr Mason informs us that the usual outlay for an ordinary sized factory, is $371,000, of which $178,500 represents the cost of the machinery. The daily output of such a plant is 600 tons, which sells f. o. b. at the factory, for $1.90 per metric ton of 2,204 lbs., and that, notwithstanding this (to an American) exceedingly low price, it was a common thing to read in the Berlin papers, official notices announcing annual dividends of brown coal briquetting companies, ranging from 15 to 20 per cent of their capital. And this, Mr. President, with a selling price of the fuel at $1.90 per ton of 2,204 lbs. I can hardly believe that one would find it necessary to sell such fuel in North Dakota, for instance, for anything like so low a price; nor do I believe that in New England even, and especially Canada, anything less than double this price need be charged, in order to find a ready market for thousands of tons.

Here the objection may be in order, that, as yet, lignite has not been discovered, either in New England or Canada. True, but we have hundreds of thousands of acres of peat, quite the equal, in many respects, to the Dakota lignite, and while it may not be briquetted quite as readily as lignite, by reason of the higher water content, yet, as I shall show you later, it can be briquetted, and that, too, at a price sufficiently attractive to offer a business inducement to any one satisfied with a reasonable profit.

Peat, unlike lignite, can be treated in several ways, each resulting in a desirable fuel, superior in every respect to hard wood, and in many respects, to most of the soft coals; it is the purpose of this paper to call your attention to the briquetting of peat, by the so-called dry process.

It is probably unnecessary for me to say that the attempts made, both in this country, and abroad, to produce a commercial fuel by the briquetting of peat, have been many and various; and that the wisest of us have yet to learn of more than one or two successes, while the failures are best not named—they run into the hundreds. The reason for these failures, in many instances, are not far to seek, while in others, one fails to understand, or find any reason why, with the machinery and opportunities, at the command of the people engaged in the enterprise, success should not have been attained.

Why, for instance, should not one expect success in making peat briquets, in a country where peat bogs are plentiful, and coal sells for $17 per ton? Yet, a failure occurred in California, within a very few years, under just these conditions. We are told, on the side, however, that the fuel was not firm, that it took up water readily, had to be shipped in box cars; and that there were serious defects in the arrangement of the plant.

All of these things taken together, may have meant just the difference between success and failure; even so, one can hardly understand it.

Briquetting machinery has been constructed in Chicago, in New York, Connecticut, Boston, and at as many as four points here in Canada, to the writer's knowledge, and in only one of those places is there anything being done today, and that is at the plant of our friend Dr. McWilliam, at Dorchester, near London, Ontario.

It may be fairly asked, why don't you back up your faith by your works? All in good time, gentlemen. In genuine Yankee fashion, I will answer that question by asking another. Who, of all those who met at the Jamestown Exposition to organize this Society, is making even so good a showing as Dr. McWilliam? And by this I do not mean to draw offensive comparisons, but I do wish to emphasize the fact, apparent to everyone, that the building up of a peat fuel industry, at a time when the exposure of fraud and dishonesty on every hand is of daily occurrence, must, of necessity, be a slow process, which should be carefully studied, from all possible view points, before much money is embarked in the enterprise.

Fortunately for us of this day and generation, the business has passed through its initial stage. I mean by this, that the gold-brick man has already run his race with it; and, although he has left his leprous trail all over our North land, the poison from which still rankles in the memory of many good men who lost their money; yet, even his work may not all have been in vain; certainly, we of today, have a clearer

atmosphere, and must be dull indeed, if we cannot draw some lessons from the records of his passage.

Following the subject of briquetting further afield, we find, according to the report of Mr. Mason, that in 1903 there were several peat briquetting plants in successful operation in Germany, the largest and most important being located at Stettin, while a still larger one was about to begin operations at a point on the Baltic coast, near Konigsberg. Investigation brings out the fact that practically the same machinery is used in these plants that is employed for the briquetting of lignite; there appears no apparent reason why it should not serve equally well with both materials. This being true, and the briquetting of lignite, as appears from the universal practice in Germany, where they are so far ahead of us in all these matters, being considered the most practical and desirable way of treatment, I desire to ask the thoughtful and fair-minded, why the same should not be true of peat, provided the extra water content can be readily and cheaply disposed of? And here we touch the vital point in the whole proposition. With the perfecting of the process for briquetting lignite, the German engineers fondly believed that a way had at last been found, by which all the troublesome problems in the manufacture of peat fuel could be forever solved. We now know, however, that their expectations fell far short of a satisfactory realization. While it is true that substantial progress has been made, it was found to be equally true that the most troublesome problem of all, that of a cheap method of expelling the excessive amount of water, still loomed large in the mechanical horizon, and it is not within the writer's knowledge that a solution of this difficulty has even yet been found, either at home or abroad, unless we concede that the methods employed by Dr. McWilliam afford sufficient suggestions to lead, by way of the improvements which always follow in the wake of every good thing, to a happy and final solution of the whole vexing matter.

This the writer firmly believes to be not only possible, but in every sense, probable. In fact, his own study and experiments of the last five years, point unmistakably to such a result. With suitable machinery for performing the work on the bog, and a proper and mechanical installation of other machinery in the factory, there will remain no good reason why peat briquets as dense and hard as dry oak wood, can not be made at a cost not to exceed $1.25 per ton, with every expense included.

You are asked to bear in mind two facts: first, that all the steps leading up to this ending are purely mechanical;

and secondly, that mechanical problems of any account have always been solved; even to the production of a successful flying machine.

A brief descripton of what is meant by "suitable" and "proper" machinery, may not be thought entirely out of place, in this connection. To clear off the surface properly, ditching and draining a section of the bog, is now pretty generally accepted as the first step to be taken by whatever process one is to operate. This done, sufficient, self-propelled machines should be put at work, pulverizing this surface for an inch or two in depth, and, after an exposure of two or three hours, collecting and transporting to the store house, the finer or dust portion of the material, about twice as fast as it will be required for keeping the factory in constant operation. Thus a surplus will be accumulated for use in rainy weather, and in the late fall, after work upon the bog has stopped for the season. This dust should be moved from where it is dumped by the car, to a separator in the top of the storehouse, by a fan using a second time, the hot air drawn through the dryer. The separator should be in a cupola having glass sides, with air vent through the roof. Thus excellent drying conditions are maintained during the acts of unloading and storing the dust, while the pile of dust is kept warm, from which constant evaporation of moisture must be going on. Dust for briqueting should be drawn only from the bottom of the pile, thus preventing excessive heating or caking: this may be taken to the dryer by bucket elevator, or other means. The dryer should be placed 8 or 10 feet above the top of the boiler, which should be in a room especially constructed for it and the dryer, having an octagonal ceiling covered with tin, both as a fire protection, and to hold the hot air accumulating from the boiler, return smoke pipe, steam pipes and other accessories of the place. All this hot air should be drawn through the dryer, which is located in the top of this room; it may be supplemented by the exhaust steam from the engine, and by such an amount of live steam as may be found necessary for the work. In this manner, all of the waste heat about the factory may be collected and made to do double duty; first in the dryer, and next for storing the dust as it comes from the bog.

From the dryer, the dust falls by gravity into the grinder, hence into a bin over the briquetting machine; from the time it leaves the grinder until it is formed into briquets, it should be excluded from the air, and means should be provided for extracting as much of the air content as possible, thus ensuring a more compact briquet. Fine grinding is a great help in this particular, as less air is held throughout the mass of material if finely ground. A small portion of the dust may be taken from the discharge end of the dryer to a separate grinder, and thence fed by a fan into the furnace as fuel. If this is done, the boiler tubes should not be less than 4 inches in diameter.

Briquetting machines are many and various. The German machines, as well as many of those tried on this side, have been of the "open tube" variety; these depend upon the friction of the compressed material in the tube for the necessary resistance in compressing the next batch, resulting in a soft briquet, or, as in the case of the tapering hole, much cutting away of the steel by the forced passage of the material, and consequent frequent stops for repairs. A more desirable form would seem to be a slow moving machine, of great power, so designed that the briquets might have a slight dwell under pressure, and thus gain a "set," which would lessen the tendency to check. The briquet should be formed in a tapering mould, and be "backed" out, thus reducing the wear to the minimum. The pressure should not be less than 8 tons to the square inch.

A machine of this class, of a capacity of four tons per hour, requiring less than 16 H. P. to run it, can be constructed and sold for $5,000; the weight would be about nine tons.

A natural question which will present itself to many, is, why all this outlay for machinery? Cannot peat fuel be produced by a simpler method? The answer to this is somewhat far-reaching, and is, first, that machinery may do the work rather than men; secondly, that a fuel sufficiently dense for locomotive use may be produced; thirdly, that the time of manufacture may be reduced to four hours, instead of twice or three times as many days; and lastly, that materials other than peat may be turned into fuel by the same line of machinery.

To illustrate: That great empire known as Western Canada, is now raising every year, vast quantities of wheat. Many thousands of tons of straw as left in vast piles by the threshers, are yearly set on fire, and destroyed, to rid the land of it. Wood and coal are both scarce and high, and much suffering results among the poor, for want of fuel. That straw, properly treated, can be briquetted into a fuel almost the equal of peat, and thus, what is now regarded as a nuisance and a curse can be turned into a great blessing for a great and growing civilization, while those who shall be instrumental in bringing about such a result may fairly claim, not to have lived in vain.

And now with a single question, the writer will close this paper, already too long: Is there still no incentive for the pursuit of the briquetting idea? (Applause.)

PROBLEMS IN PEAT FILLER PRODUCTION.

MR. ROBERT RANSON: We have a paper from Mr. J. N. Hoff on "Some Problems of the Peat Filler Manufacture," which I will now read to you:

"For five years or more the fertilizer trade has been using well rotted dry peat as an ammoniate filler, at first in a very small way, brought in by the back door, so to speak, and at present in increasing quantities and with less secrecy.

When the production of this material began, so little was known in a practical was as to the proper methods of production and the process appeared so simple, that the visions of wealth it was to create brought several concerns into the field and the promise of more. Their experience has been much the same, in most instances, as those of the earlier pioneers in the peat fuel business, roseate vistas of wealth, which proved less even than mirages as to realization.

At the present time some four or five plants are producing peat fertilizer filler in the United States, in commercial quantities, turning out in all, perhaps 15,000 to 20,000 tons per year, and it may be safely said, with little profit, due, as in the fuel business, to the enormous percentage of water, as compared with dry material in natural peat, and the difficuulty and expense of drying a mass in which a ton must be handled to produce 200 to 300 pounds of marketable product.

Theoretically it looks easy; in practice, taking into account vagaries of the weather, it has proven exceedingly difficult. The lack of greater sucess in the peat filler business as that of peat for fuel lies mainly in the field operations, coupled with improper condition of the deposit to be worked and uncertainty of weather conditions.

Your production problem is to dig, disintegrate and get rid of 1700 pounds of water to produce 300 pounds of material worth at most $5.00 per ton on board cars, and make at the same time a living profit.

Hand digging and direct drying of the freshly dug material have been carried on without profit wherever tried, as the cost of digging, hauling, fuel and labor, and wear and tear on plant, have been so great.

Piling up the dug material with the idea of draining it does not work out to any extent in practice. Peat in its natural condition has a cellular structure and holds moisture tenaciously.

Various presses have been tried, but with added expense and poor results.

Again, peat to make a salable filler must be well rotted and contain at least 3.5 per cent. of nitrogen as ammonia. Such peat is only found on bogs which are drained and aerated sufficiently

to decay and concentrate. Submerged bogs seldom exceed to 2 to 2.5 per cent. ammonia, while well aerated bogs on, or near, the surface sometimes analyse 4 per cent. ammonia and seldom fall below 3 per cent. in practice.

As an acre foot of average bog does not produce over 150 tons of merchantable filler, a large area must be worked.

From the foregoing it would apear, first, that the bog must be extensive enough to warrant the erection of a suitable drying plant; the bog must be in condition to ditch and thoroughly drain to a depth below the point you wish to dig. This can be done with open ditches when the natural fall is sufficient to carry off the water, or by diking each area to be worked and pumping out the ditch water from that particular tract with a rotary pump.

The next step is to clear the surface of bog heads and sod and plow and harrow to produce proper aeration.

Then some method of digging and hauling must be used that will take full advantage of nature to rid your dug material of every particle of water possible, before taking it to the driers, as every ton of water removed by artificial heat takes 250 to 300 pounds of coal, and if your wet material is 85 per cent moisture when put in the drier, this means the consumption of almost a ton of coal for each ton of finished product.

One of the most practical and cheapest machine methods of digging, disintegrating and sun drying in use, is Dobson's peat harvesting machine which when operated by one man and less than 20 H. P. motor, will dig, disintegrate and scatter in a thin layer over the field 400 tons or more of dug material in 10 hours, which in clear weather can be scraped up in 24 hours, contains less than 50 per cent moisture.

A simple form of scraper also operated with an electric motor and one man, will scrape into windrows all the digger throws out. When the material is scraped into windrows along the track, it can be loaded mechanically or can be shovelled into cars by hand labor and under normal conditions the 400 tons of wet material will have shrunk to 120 tons, thus saving haulage to plant of 280 tons and burning fuel to drive off that much water.

On the other hand if you will properly use a harrow of the Acme type which stirs up and disintegrates only a thin surface layer and may be drawn by one or two horses, much of the moisture goes off and your scraper will gather the dry peat as when dug with the digging machine.

Drying disintegrated peat containing 50 per cent or less moisture is a comparatively simple matter. When every 1,000

pounds of water driven off by the aid of fuel produces at least 1,000 pounds of dry material, the fuel cost has been reduced on an average from nearly $3.00 per ton to 30 cents.

Ample facilities for storage of the sun dry material must be supplied so that the plant can operate continuously, regardless of bad weather and also in the winter, so as to supply the fertilizer trade with the filler to mix in their spring fertilizers which they start delivery to consumers in March.

Do not attempt to store the dry material in quantity, for sooner or later you will have a disastrous fire. Store the sun dry material and dry as shipment requires.

The ordinary type of direct heat drier, a 10 mesh rotary screen, and mill to grind the tailings will answer all purposes.

In building a plant have it fireproof; take no chances. The trade requires heavy winter and early spring deliveries. The material should contain less than 10 per cent moisture and at least 3 per cent or more ammonia and must be in fine mechanical condition.

It is possible to handle the wet peat by means of a dredge with suitable drying space on which the wet material could be spread out after disintegration and again scraped up when sun dry, provided the peat runs high enough in ammonia to make it worth while, which is seldom the case.

One serious aspect of the business is the question which has arisen as to the availability of the peat nitrogen as compared with that in blood, animal tankage, or ammonia salts. Some state departments of agriculture have gone so far as to assign a very low value to peat nitrogen, less than 1-5 that of nitrogen in nitrate of soda. Much research work is being done to definitely settle the plant food value of peat. That it makes an ideal dryer and filler there is no question and as it is identical with the humus on which all soil depends for natural fertility, its plant food value under proper conditions should not be questioned.

Attempts are being made to treat the wet material in such manner as to induce more rapid decay in order to increase the content of available nitrogen present, but not yet in a commercial way.

The present status of the filler business as a profitable industry is not what was expected, yet it is to be hoped, with the experience gained, that with a well-drained bog, the ability to take full advantage of nature in removing all moisture possible, and a well-equuipped storage and drying plant, some profit can be shown elsewhere than on paper. (Applause.)

A MEMBER: What about spontaneous combustion?

PROF. DAVIS: There is a possibility of spontaneous combustion from heating—if a certain fungi get into the stored peat when it is in a favorable condition there is a tendency to heat and spontaneous combustion may result.

THE CHAIRMAN: I have always found Mr. Hoff ready to show his plant.

PROF. DAVIS: Before we leave this drying question we ought to have a few words from Mr. C. E. Mark who has a method that seems applicable to peat.

MR. MARK, being called upon, said: We have put a simple thing in operation and we are prepared to build a plant and put it in operation and take it out if it does not do what we claim. If you will give us your lowest figure for drying peat we will agree to dry it 10 per cent less, with an increase in production of 10 per cent. We will dry the material in ordinary atmosphere without artificial heat. Our capacity is unlimited. If it is a matter of the quantity that you desire to treat, that will regulate the size of the plant—we can go up to 1,000 feet length according to the needs. We are going to take the easiest and most natural way to do the drying; you realize that this is to apply the heat underneath and through the peat. In no country have I been able to find that the material has been treated through a porous hearth. The plant I have was put up to handle 10 tons of dry material a day and its capacity is 100 tons at 55 per cent moisture down to 12 or 15 per cent. The ratio is in the capacity of the plant. The moisture is blown away with 212° temperature. It cost me some $30,000 to find this out and have the process patented. I had no knowledge that there was such a society as The American Peat Society until last Thursday night, when I saw a notice in the paper that the Society was to hold a meeting here, and I lost no time in coming on. I was brought up on one of the big peat bogs in the United States. We are not here to sell stock but we are here to show a principle that you cannot get away from, and that is to dry from the underside and carry away the material which you desire to get away.

A MEMBER: The plant was built to dry how many tons?

MR. MARK: Ten tons a day from 55 per cent moisture to 12 or 15, and the actual performance was with 240 degrees temperature, 110 tons a day.

A MEMBER: That is 100 tons more than you figured on?

MR. MARK: Yes.

A MEMBER: What material?

MR. MARK: Tankage and blood. We could not find figures upon which to base anything definite in building a plant. We had the plant built under contract and there was a discussion as to size. I said make it 30 feet long and 6 feet wide and our chief engineer said 60 feet long and 7 feet wide and I said, "Let it go at that."

A MEMBER: How long have you been running?

MR. MARK: Since last February.

A MEMBER: How do you find wear and tear on that?

MR. MARK: The outside is all concrete and everything except the ravel in scots and journals. That is the wear and tear on the latter in a little every four years but the depreciation of the rest is practically nil.

A MEMBER: What would be the approximate cost of a plant put up at a bog?

MR. MARK: We will put it in with a guarantee for its operation and divide in half the saving in what it costs after installation to dry peat compared with the former costs. In that way you will pay for all out of the savings.

A MEMBER: And what would be the drying cost approximately?

MR. MARK: That would be determined by the tonnage. We take the contract to reduce the cost 10 per cent and increase the capacity 10 per cent. We are figuring now on a sugar pulp plant of 4,000 tons capacity.

A MEMBER: What would be the cost of drying there?

MR. MARK: That is something we have not yet given away, but we take the contract to reduce the cost 50 per cent and increase the capacity 50 per cent in that case. All we require in heat is something above steam temperature to do rapid work. We are using one drier to take the natural heat out of fruits in order to prepare them for shipment. Our original method was in drying metal.

A MEMBER: Do the scrapers consist of iron or brush?

MR. MARK: They are angle bars. The chain is a special pattern of our own which allows it to run within 3-16th of an inch of the hearth.

A MEMBER: How do you get rid of the dry material and leave the rest of it that is not dry?

MR. MARK: The first application of the heat is on the end that is being moved over, and before the substance gets

to the other end of the hearth it is all dried. The depth of the material on the hearth is anywhere from 2 to 6 or 8 inches deep according to the material itself.

MR. DAVIS: In handling loose peat will the outside pile up and leave the inside wet—is there any provision for that?

MR. MARK: In handling blood and tankage for fertilizers they go to pieces before getting to the far end of the hearth and go into absolutely fine material. The waste material is grated off and it will go to pieces and if it will do it with blood, it will with peat. The material is turned over automatically over the hearth the whole time.

A MEMBER: What are your terms?

MR. MARK: Stating generally they are these: We will go to your place, build a plant, put it in operation, and take it out of it does not do what we state, and it will not cost you a cent. We agree to reduce your cost 10 per cent and increase your capacity 10 per cent and we will set a nominal price, which is lower than you could buy the same machine now doing the work— that will be the price to use that machine. We will take our pay out of the savings we make above the 10 per cent and you pay us for the machine from your half of the savings over 10 per cent. It means if you let us come and put up a plant, we will pay you for using it and if we don't get anything out of it, we do not make anything and if we do, we will be satisfied with half of what you make.

MR. MOORE: Do I understand you correctly to say that in drying such materials you would do it by heated air or by natural air?

MR. MARK: It is according to the tonnage of the plant. If the tonnage runs too high we will take whatever waste heat is available.

MR. MOORE: Supposing no waste heat is available, you would not attempt to artificially heat your air to 212°?

MR. MARK: To 240°.

MR. MOORE: Do you supply air at 240°?

MR. MARK: Probably to that but not above that.

MR. MOORE: All the water from that material goes out into the air?

MR. MARK: In the form of steam.

MR. MOORE: Can you say approximately the temperature of the vapors leaving the machine, would it be 212°?

MR. MARK: No, I do not think it would.

MR. MOORE: The reason I ask is this that water can be maintained in air in two different ways, as water vapor, such as the clouds, at a temperature not as high as 212°, or it can be maintained in air as steam. The water from the drier must pass off in one of these two ways; there is a very great difference in the cost to get water into vapor under these two conditions. You have to apply a great many heat units to change the water from a condition of vapor to gas. Are you sending it off as steam, or as water vapor?

MR. MARK: I have never been taught the exact working of temperature. We simply see the steam floating off in the air.

MR. MOORE: If the water leaves as steam I can say how much heat you supply; it is a very definite quantity and a very considerable quantity, but if it goes off as water vapor the operation would be slower and you would not have to supply heat but you would have to supply enormous quantities of air. On some materials you said you did not use artificial heat?

MR. MARK: I will say regarding the material we are handling now that it must be taken into consideration that it is delivered to us hot, but not boiling hot.

MR. MOORE: The point that the laymen does not grasp is this; a British thermal unit is the quantity of heat needed to raise one pound of water, one degree Fahrenheit and to bring water from the freezing point to 212° F. requires 180 British thermal units. A peculiar thing happens at 212°—the water remains at that temperature and you still can supply heat to it and the temperature of the water will not increase. You can apply more than 900 heat units to the water and it will not get any hotter, but will change its physical condition from liquid to gas. The expense in all drying operations where the water is driven off as steam does not consist in raising the temperature to 212° but in making that physical change, having to supply almost six times as much heat as that needed to raise the temperature in the first place, and that immense quantity is practically lost. Hence my question is, whether you are taking that water off as steam, because if you are, it is just like boiling it out of peat.

MR. MARK: We get a certain capacity in the drier and we get the air under it and we use the conditions existing at any particular place. If necessary to build a heating plant we do so, but in almost every case there is some condition arising so that we obtain heat outside of a plant. In winter we have to use heat but we go into the smokestack for the heat

without building a separate heating plant. For illustration, in putting in our first plant we have taken the waste gases from one of the six boilers in the main factory and obtain the required heat in that way.

A MEMBER: Does this tankage contain 50 per cent moisture when you get it and dry it to 12 per cent?

MR. MARK: Yes.

A MEMBER: What is the value of a ton of this material?

MR. MARK: That I can only say in an off-hand way, but from $25 to $35 a ton.

A MEMBER: Then to dry a ton of that material you can spend a large quantity of heat and make it valuable, but to use the same amount of heat on a ton of stuff worth only half of what you are drying now the proportions would be very different—that is the amount of heat you have to supply becomes a very material thing?

MR. MARK: Taking the other side of that, here is a material costing a dollar a ton to dry—we agree to do it for less. (Applause.) If you show us the material you are drying for 60 cents a ton we are prepared to do the same thing for less.

THE CHAIRMAN: We have listened with much interest to Mr. Mark, but there are certain established laws in regard to heat units that will give certain results and will give no more. What is claimed is that this drier is more efficient than any other and we want to know what the percentage of that increased efficiency is. The proposition looks to be a pretty good one, yet at the same time I might not be willing for you to start it unless you could give me the figures—however, I am very much interested in it.

MR. MARK: It has been my policy throughout my life to do whatever I tell a man I can do, and whatever I have put upon the market has been a success. We never ask any one to spend a cent of money until we do the work. When we go into this field thoroughly we will know where we stand. The peat problem is not a drying problem alone. To dry peat for fertilizer filler is easy to us in connection with the others, to dry the peat for fuel purposes, is another problem entirely. I did not come here with the idea of selling any one a drier. I have given a plain statement of what we are doing and what we have got.

DR. MIGHILL: Perhaps I can show where there is some superiority in Mr. Mark's drier. He produces increased

efficiency. That is what we do in making air dried peat. If you should run air through that machine, at ordinary atmospheric temperature and evaporate water, the air would come out colder than when it went in, and it is that loss in temperature multiplied by the amount of air that goes in that determines the amount of work that has been done in drying that material outside of mechanical means. Now, where does that heat come from? Is it from the sun that warms the air before entering the machine, and there, to my mind, is a point that ought to be well considered by peat men; we might use the heat of the sun very profitably, and we do it by producing artificial holes in our dry house to increase the circulation of air to dry out the moisture of the stored peat and therefore add more heat units to the fuel. Another point that might be considered is in regard to the use of steam. The heat used in producing that need not all be lost, for the condensation of that steam returns to the air, theoretically, the same number of heat units needed to make the steam. If air is passed through the condensers before going to the drier it will go into the machine warm, the same as in any condensation; it is just a matter of efficiency. I myself do not know very much about this machine, but I think there is something of considerable importance to peat men in this principle. (Applause.)

MR. MARK: I have put this drier in operation and it has exceeded my own expectations by far. I figured that we would use from 360 to 420 degrees of heat to dry the material; it was just my general estimate, and when I came to run the material through, I found I could get down to 120° with an 8° below zero temperature outside at the time I did it. I found I could dry the material with ordinary air, and Dr. Mighill has given an explanation that I never dreamed of before. When we say we can do it we know we can.

MR. MOORE: I wish to explain that the idea I had was not any intention whatever of criticising your work or of trying to make out you were misrepresenting in any way. I am a man who wants to look into these things. I want to find out if there are any conditions in your drier that are not evident on the surface. You have told us you dried from heated air in plants where there was waste heat, you have given no estimate as to how much waste heat you use and it was to find that out I asked the question, Does the temperature of the upper part of the plant runs about 212 degrees?

MR. MARK: I have not taken the temperature at the exhaust pipe. I did at another point, but there we had no

sign of steam. This plant has 132 cubic feet of air capacity per minute.

PROF. DAVIS: It seems to me that the question now resolves itself to this—that there never has been any question of the quantity of heat units used, in Mr. Mark's mind, because he has had success in his operations. If he got down to where the heat units were not sufficient for his purpose then the question would arise, but up to the present there has been heat and air enough to do the work needed and the margin of waste has been so large that there has been no need to consider these questions. If the plan, on trial with peat, shows the same efficiency, fuel economists will be impressed by the method and then the increase in output will be brought down to figures.

A MEMBER: Do you say your scheme would not only dry it but leave it like powder at this end?

MR. MARK: Yes, in the pulverized form.

A MEMBER: You can make your capacity what you will?

MR. MARK: Yes.

The meeting then adjourned until the afternoon.

AFTERNOON SESSION.

Wednesday, July 27th, 1910.

When the Society resumed its session the following resolutions of thanks were submitted and adopted by a rising vote of the members:

Resolved: That the most hearty thanks of The American Peat Society are tendered to the Reception Committee, the Mayor of Ottawa and the Board of Control, Members of Parliament and the Legislature for Ottawa, and members of the Publicity Committee and Board of Trade and to the citizens of Ottawa for their hospitality and the splendid provision made for the entertainment of the Society at its Fourth Annual Meeting in the beautiful Capital City.

That especial thanks and appreciation be tendered to the Dominion Director of Mines, our presiding officer and President, Dr. Eugene Haanel, who as chairman of the local committee, has been untiring in his efforts to make our meeting a success, and to his able co-worker, Mr. Arthur J. Forward, B. A., the Secretary of the Committee of Arrangements.

That a vote of thanks be tendered to Controller Hinchey, to Hon. Clifford Sifton, to the Minister of Agriculture, Hon. Sydney Fisher, and to the United States Consul General, John G. Foster, for their valuable and interesting addresses and to Mr. John R. Reid, Vice-President of the Board of Trade, for his kindness in acting as toastmaster.

That a vote of thanks be tendered the Principal of the Provincial Normal School, Dr. J. F. Whyte, for the use of the beautiful and comfortable building under his care for our meetings.

Resolved: That The American Peat Society hereby expresses its thanks to the Hon. Wm. Templeman, Minister of Mines, for his cordial welcoming telegram and for the opportunity to visit the most interesting and satisfactory demonstration peat fuel plant at Alfred, and the peat gas-producer and power plant in Ottawa. That congratulations are extended to the Minister and to the Director and experts in charge of these plants for the success that has crowned their efforts, and the very important demonstration which they have made of the practicability of making peat fuel in quantities and of using it for the production of power.

That the thanks of the Society be tendered its Secretary-Treasurer for his self-sacrificing and untiring work on behalf of the cause of diffusing knowledge regarding peat utilization, for the welfare of the Society and for the success of this meeting.

That the thanks of the Society be tendered to the members of the local press for the excellent and very full reports of the meetings of the Society which have been published by the city papers.

The Secretary is hereby requested to place these resolutions on the minutes of the Society and to send copies to the gentlemen named and to the press.

Signed, CHARLES A. DAVIS,
FELIX A. VOGEL,
T. A. MIGHILL,
Committee.

MR. BULASK: In connection with the rising vote offered to our Secretary, Mr. Bordollo, you will remember I made a motion that the Secretary be placed on our roll of honorary membership. I think we owe it to our Secretary to show him appreciation of his work in that way. It is practically the only thing we can do at the present time and it is

only due to him that he should be among the honorary members. I therefore renew my motion.

The motion was duly seconded and unanimously carried, and Mr. Bordollo extended his sincere thanks to the Society for the distinct honor conferred upon him.

DR. McWILLIAM: Has the date of the next annual meeting been discussed?

THE SECRETARY: No, the date is to be fixed by the chairman and it probably will be fixed for September; it is left in the hands of the local committee.

THE CHAIRMAN: An idea has been suggested to me by Mr. Askwith of Ottawa to make it a point at our next meeting to introduce the members to one another in order that they might become acquainted.

MR. F. J. BULASK then gave a summary of his paper already submitted on the work of the Peat Engineering Company, for the benefit of some of the members who were not present when the paper was presented.

MR. MOORE: In connection with the last statement just read I would like to go on record in saying that we have evidence in Canada today that bears out that paper exactly, that is, in general about the design mentioned. Our plant for Farnham differs in details but the principles of doing away with track laying and labor are steps in the manufacture of peat fuel which are to me greater than have been made heretofore.

A MEMBER: Are any of your machines in operation?

MR. BULASK: There is one near Fort Wayne, Indiana. When I left Toledo they were operating the machine with a lighter cable than required. The motor is 20 horse power but it was stated that the machine dug the quantity of peat figured on with just 3.5 horse power.

A MEMBER: You haven't had a chance to know how the windrower handled the peat?

MR. BULASK: No, we hadn't peat dry enough.

A MEMBER: Would you brick up the peat for fuel purposes?

MR. BULASK: It all depends on how dry you let it get before you do that. I have been questioned on just how we do this work, so I will draw a diagram. The machine starts at the lower end of the bog and digs a trench 29 inches wide

and 3 feet deep and lays out the peat as dug alongside the drain in long narrow strips.

A MEMBER: How deep can you dig?

MR. BULASK: The machine in Fort Wayne is on a bog 4 feet deep and they figure 3 feet would take off all they want, but the worms can be lengthened to 9 or 10 feet. After the machine has carried on the digging sufficiently so that the peat first dug has had time to dry the windrower turns the dry stuff over into a pile or windrow making room for the machine to widen the trench another 20 inches.

A MEMBER: If you take off 9 feet, do you not spread the stuff so thick that it will not dry properly?

MR. BULASK: It is quite feasable to spread it out on a wider area and not put it too much in heaps.

THE CHAIRMAN: I really ought not to take up so much time of the Society, but I am doing what I was told and obeying the command of the Society. I am entirely in the position of a learner and in no sense a teacher. I have no special claim to any particular knowledge of peat manufacture except the experience I have had so far as I have gone. So much has been said at all meetings of the Society of the wet process, and this one proposition is a little exception in the way of making peat fuel and the impression has gone abroad that there is no other way of making peat than that described. It has generally been a fact that when I mention the subject of briquetting peat I am met with this expression by everybody I have ever talked to on the subject: "That has been tried in Europe and it failed and that is the end of the matter—you need not try it any more." Now. Mr. President and gentlemen, I would have said before today that I knew all that was to be known about the drying of peat, but as an illustration of how little one knows and of how much he does not know we only have to study the papers this morning. Mr. Ranson's demonstration of a double tube drier was a revelation to me. I thought I knew something about drying peat with direct heat and yet Mr. Ranson was able to come here and give me a completely new idea which I know is of great advantage and makes quite possible the overcoming of all the difficulties I ever had. Having hardly got my breath from astonishment at the idea of drying five tons of peat of 30 per cent moisture with 97 pounds of coal, which to me was certainly an amazing statement, when right on top of it Mr. Mark comes along and gives us a picture and pretty nearly convinces me that he can discount Mr. Ranson's idea altogether—he uses a couple of fans and does the trick with the

outside air. I have discovered a few things which make me think his secret will work; what he does is this, he brings into contact with every particle of his peat, air coming out of very fine pores. We all know that if a farmer puts his hay in the sun with 50 per cent water in it, in a day or two it is dried down to 20 per cent. What happened? It was not the heat of the sun altogether—that has not very much to do with the drying—it is the circulation of the air. It seems to me that air in our regions, at ordinary temperatures is saturated with moisture at 15 per cent and it will not dry peat and similar substances below 15 per cent. The air out of doors in this climate contains about 8 per cent water in the summer time. It needs more water to saturate it and the hotter it is the more in need of moisture it becomes, and it picks the moisture from the hay and peat until it carries away the greater part of it. I think if Mr. Mark's plan is successful, it is because it brings air that was searching for more moisture into contact with the very fine particles he is trying to dry. That illustrates, to my mind, the foolishness and absurdity of any man saying he knows all about any subject, and the man who says, "There is no use trying to briquet peat," may be right, but he is very likely, in the light of what happened today, to be mistaken.

Why did peat briquetting fail in Europe? They got their peat dried just the same as Mr. Bulask has described, the same as at Alfred; in Europe it takes a long time before peat begins to dry. Then they took the dry blocks and powdered them—they had a crude form of drying and they had a press that I would consider an impossibility. It was a plunger press and pressed out coke. The peat dust used had a large percentage of air and they compressed the air along with dust—the result was that the compressed air would not stay compressed and it disintegrated the briquets and after a time they were reduced to powder. On the basis of experience with that plan we are told by some that you need not try to briquet peat. But my attention was called to a plan invented by W. A. Milne and Sons, near Toronto, and I thought they had eliminated nearly all the difficulties. To dry the peat down to 25 per cent moisture they used the same means as Mr. Bulask and as those used at the bog at Alfred, the only expense was a horse hauling a harrow over the bog. I have seen the horse work an hour drawing a large harrow but he stood more than half the time. I have seen them pick up 12 tons of dry peat from the area he harrowed in an hour. You could pick the peat up as fast as you liked—2.5 tons came in in 15 minutes. We have crude appliances, but in the face of

all that, I have seen 5 tons gathered in an hour. I have often stood on the bog and made a calculation. A fireman and the other workmen get so much wages and I divided the hours of wages by the number of tons coming into the bins, and often I have seen tons of peat coming in there on which the wage item was 7½ cents a ton and put in the bins containing 25 per cent moisture. That cannot be done steadily, however, on account of wet weather, etc. At night I was able to say, "The peat went in today at about 25 cents a ton."

In Europe, in briquetting peat they had an expensive plan of grinding it. We begin in an entirely different way. By actual experiment 75 per cent of the material gathered would pass a 60 mesh and the coarsest of it will go through as very fine powder—it is as dry as dust, I consider, but still it contains 25 per cent moisture. If the briquetting machine is running then it goes immediately from the dump car into the drier to be dried down to 10 per cent. There is where our whole difficulty comes in. Some one said it is hard to get rid of the first 10 per cent—that is not our difficulty. Ours was to get rid of the last percentage.

We bought an old dryer that was used at Beaverton and peat went through it. Now what was our difficulty? Our peat was ready to burn when we picked it up—it would explode if you threw it on a fire—but we put into this drier, which was heated by direct heat from roots from the bog, and we were constantly having fires. Another thing, we connected the exhaust from this drier to the smokestack, 60 feet high, and 50 per cent. of our peat went up that smokestack. We weighed a ton through the drier and put the remainder after drying on scales and all we could get was 700 pounds and 300 pounds of water. What became of the other 1,000 pounds? It went up the flue. Then what did we do? I concluded that we were heating too hot and also that if our boiler evaporated water enough to give 250 horse power per hour, and a ton an hour was all the peat we dried, when all we tried to evaporate was 30 gallons of water, the drier was a poor one.

So we got a drier built last year to use our exhaust steam for the heating, but it has given so much trouble that we have been unable to run a ton an hour all season. I did hope to say we were making money, but the meeting is earlier than expected and consequently I am unable to give a complete report of our month. But if Mr. Mark will accept a challenge from me and come over and put in a drier at Dorchester I certainly shall communicate with you through the columns of our journel and tell the results of his plan. If he can do 4 per cent. of what he says he can this plant

will make money hand over fist. We have the peat in the bin ready for him. Or if Mr. Ranson's drier will work as he says, the question is settled as regards the briquetting of peat. I am not making a comparison as between the briquetting and the drying process—I am just pointing out plans by which we might succeed as an apology for venturing to say a word or two on briquetting of peat, and I thought the Society was entitled to a little explanation.

MR. MOORE: I would like to go on record about doing this and doing it cheaply, and I cannot see how he can get over the difficulty by even the drier Mr. Ranson has shown, for the reason that in any device where the products of combustion are brought into direct contact with the material to be dried, one little spark may always get in and that is enough to start combustion. Apart from that the drying by steam is done right along, and I think it is only a matter of one small mechanical difficulty that prevents it from working. We hope it will be only a month or so before this will be overcome.

MR. MARK: I think before very many weeks have gone past we will get together and accept your challenge. It is rather sudden for me to make an offer but I think we will get together and rig up a drier for you.

A MEMBER: In the bog we have been operating to some extent we have trouble because our drier does not thoroughly disintegrate some of the fibrous roots and limbs, and these limbs get into our machine and cause trouble and I am anxious to know if your process will thoroughly powder those limbs?

MR. MARK: The limbs or material such as roots will be thoroughly ground up going through the drier; it will not disintegrate woody roots but the fibre part of the peat would be thoroughly powdered when it came through. There would be a small per cent. the size of a pea but that could be brought back again and powdered, but anything in the solid form would have to go through a pulverizer. That part we would not attempt to handle, but it would go through just the same.

THE CHAIRMAN: The Dominion Chemist, Dr. Shutt, is with us from the Experimental Farm, and we might have a word from him.

DR. SHUTT: I can only express regret that my duties have prevented me from being present at all your sessions. I have another regret that I did not see you when at the

Farm yesterday. That was an unfortunate mistake as I would like to show you something of interest in order that you might compare results and see what we are doing for agriculture at the Farm. Now as regards the subject which brings you together today—Peat.

We ought to have in Canada as great an interest as you in the United States for two reasons, perhaps three—we have very extensive areas of peat deposits in Canada, and in fact one has only to cossider the climatic conditions which prevail in Eastern Ontario to see the reason why we have these large peat and so-called muck deposits. Another reason which touches us individually is the fact here that we have very long winters and the question of fuel is very important. It is worth while for the Government to spend some money to see if we cannot put on the market a fuel to burn at home. I am only interested casually in peat as a prospective fuel although a good many years ago I went to Newington and took photographs and am sorry the result there was not successful financially. I want to say that from the agricultural point of view I am, and will be, interested in this question of peat deposits.

As the agricultural chemist of Canada I naturally have been looking about to see what resources we could use as materials to restore plant food to the soil, that is, natural fertilizers, and we have a number of them in Canada—peat looms a very large area. I have made many analyses from deposits in Canada and British Columbia, so that in the pages on the Annual Report for the Experimental Farm for the past 22 years you will find a considerable amount of data with reference to the composition of our peat deposits. Of course this will not be of interest to you who are looking for peat as a fuel, because we have not taken the heat values but have only determined the plant food in them and especially the percentage of nitrogen.

The question of using the material as a litter upon the farm homesteads demands attention. After drying fibrous peat by exposure to the atmosphere it is used as a litter about the farm buildings for the absorption of liquid manure, which is a very important use. That has been a great benefit since the subsequent results have been known. There are also isolated cases which stand out prominently, in which the direct application of peat to the soil has been of advantage. The third point is the reclamation of our muck lands, not so much the true peat, and the bringing of these into successful agriculture, and it is possible there that we shall meet with the greatest difficulties. We have been at work on this for

a number of years, and while some of such soils respond readily to applications of fertilizers, others have not responded and we have found it was partly due to climatic conditions, and partly because the soil dried out to too great a degree, but the matter is one that will take many years to settle, and owing to the interest in agriculture, it will be always a subject for attention. When you come back again I hope you will find the peat industry different from today, and I hope to be able to say something from an agricultural point of view on the subject. There is a great future for peat utilization when we get brains and capital working together at it. I wish the movement all success. (Applause).

THE AKERLUND GAS PRODUCER.

THE CHAIRMAN then read a paper on Latest Achievements of the Akerlund Gas Producer, by C. P. Wood, of the Gibbs Gas Engine Co, Atlanta, Georgia, as follows:

Gas-producer designers irrespective of other considerations, have before them the following requirements for the successful bituminous gas producer:

(1) Constant supply of gas from commercial bituminous fuel.

(2) Gas of uniform quality—constant heat value.

(3) Gas free from impurities which clog the engine valves and cause the piston to wear and leak.

(4) Gas cool enough to have proper density.

(5) Ability to supply power for sudden increases of load.

(6) Absence of any feature which introduces an element of uncertainty.

(7) Maximum thermal efficiency without sacrifice of simplicity in operation, and with minimum of attention.

Bituminous producers may be classified under the following general types:

Up-draft pressure producers.
Down-draft pressure producers.
Up-draft suction producers.
Two-zone suction producers.
One-zone suction down-draft producers.

The advantages of the suction producer are generally ackknowledged. It remains only to develop this type to the point where the most important principles will be well balanced to give the best results to meet average practical conditions of operation.

Apparatus for cooling and scrubbing the gas does not bear upon the type of the plant, and is to be considered

separately. The apparatus is the same in principle for all down-draft producers.

The single-zone suction down draft type, with grateless generator and internal vaporizer, is the latest development in bituminous gas producers. Its success depends upon the balance referred to above, the most important point of the balance being, as with all gas producers, the relation between the effective gas-making area and the fuel for which the producer is designed. The Akerlund producer, which has been chosen as the subject of this paper, is of this type. The grateless generator shell includes an annular vaporizer somewhat below the fire line. The shell is supported on piers in a water seal with a central ash pier to prevent accumulation of clinkers and to divert ashes conveniently for removal through the water. The vaporizer acts as the support for a fire-brick lining, its outer wall, in connection with inner wall of shell and horizontal baffle plate, forming a semi-annular gas accumulating chamber which causes suction to be distributed uniformly over the fuel bed. Induction pipes inclosed by the brick lining introduce air above the surface of the water in vaporizer, and the saturated vapor is led through other pre-heating and superheating pipes surrounded by the brick lining to a point above the fuel in upper part of the gas generating chamber. Suction downward through the fire accomplishes the usual combination of gases, and producer gas is delivered to the accumulating chamber containing only gaseous tar and suspended matter as impurities. The provision for cooling and scrubbing is ample to accomplish the desired results without waste of water, and gas is delivered to the engine uniform in quality and free from impurities. It is not the purpose of this paper to dwell upon details that do not affect the vital principle of the Akerlund Producer. Those interested in a full illustrated description are referred to Iron Age, page 64, July 7, 1910.

It has been contended that bituminous gas producers would not operate successfully in units of less than 100 H. P. The Akerlund Producer has disproved this theory, and is built in units from 25 H. P. to 500 H. P. A 25 H. P. plant in South Jacksonville, Fla., has been running a year on average brake load less than 20 H. P., using ordinary southern bituminous coal; it has been found by the owners to be economical. The fire in this plant has been burning since August 5, 1909.

Following are the average results of a 12 day test of a 250 H. P. Akerlund Produucer connected with an Otto 4-cycle, single cylinder, single acting, throttling engine, in-

stalled at the plant of the Union Manufacturing Company (hosiery, spinning and knitting mill), Union Point, Ga.:

Average hrs. run per day	10.2
" minimum brake horse power	160.
" lbs. coal per hour	166.1
" lbs. per brake horse power hour	1.034
" times coal charged per day	14.4
" times producer poked per day	8.
" times ashes taken out per day	1.
" times gas samples taken per day	13.6
" producer load factor	.64
" B. t. u. per cu. ft. gas	123.67

Note: Fuel consumption includes all lay-over periods for nights and Sundays.

Coal used included several grades of Alabama and Tennessee bituminous, some clean and some low grade run-of-mine.

During August, 1909, Florida peat was tested in the Akerlund plant at South Jacksonville. A three days' supply of average sun and air dried peat very high in moisture was used, and it was found possible to make clean rich gas with the same suction down-draft producer used for bituminous coal. It was not feasible to make accurate analyses of the gas at the time, but its heat value can be approximated as high as the fact that the engine was kept up to speed under the same load that had been carried with coal. The consumption was estimated at two lbs. of peat to one pound of clean bituminous coal—it being possible to reduce this proportion with the same grade of peat lower in moisture. The gas was found to be cleaner than coal gas, requiring, therefore, less extensive provision for cooling and scrubbing. This test gave the data to determine modifications necessary for a special design of peat producer differing only in minor details from the regular bituminous coal plant. Although the comparitively greater field for bituminous coal producers has prevented the exploitation of the peat producer, the essential features have been demonstrated to the satisfaction of competent experts.

A reason for not giving definite figures for results obtainable with peat fuel is that the quality of this fuel varies greatly. Estimates should always be based on test of average sample of the peat available at the locality of the plant. Air and sun dried peat is satisfactory for gas producers, provided the moisture does not run higher than 25 per cent., the lower the moisture, of course, the better. Except when

by-products can be recovered at a profit, the question of whether to use coal or peat should be decided by considering heat value of the fuel in comparison with the cost delivered—e. g. soft coal containing 14,000 B. t. u. per lb. would be just as economical at $3.00 per ton as peat containing 11,000 B. t. u. per lb. at $2.36 per ton. Assuming cost of peat at the bog to be the same as cost of coal at the mine, which is opproximately correct, delivery cost in this case would have to be 64 cents per ton in favor of peat to make it available.

We may say, therefore, that the location of gas power plants using peat as fuel is confined to a distance from the bog determined by a radius which describes a circle within which coal cannot be delivered at a cost per B. t. u. less than the cost of peat. There are localities where the peat bogs are very remote from the coal fields, and in these localities is where the peat producer must be exploited. When circumstances combine here to furnish the necessary market for power, large central gas power plants with peat fuel can sell power profitably at a rate lower than the average which is offered by the most advanced hydro-electric developments.

PEAT FUEL BY FRANK'S PROCESS.

Mr. Frank Frank, of Guelph, Ont., was next heard from on his experience with peat, and his process, as follows:

While so far manufacturing Peat Fuel by mechanical drying process has proved a failure, it should not be concluded that this can not be done and done successfully, and I regret to learn that this process is considered impractical and should be abandoned.

Now, Mr. President, there is a process which is not only simple, but will mechanically dry and manufacture good peat fuel in 15 or 20 minutes, without air-drying the raw material before manufacture, or air-drying it in the usual way afterwards. By this process peat fuel can be manufactured during the whole year without requiring large areas for air-drying the raw material or the product afterwards.

While there is no plant in operation, I can say this that I have the opinion of a competent mechanical engineer who is quite conversant with the various European as well as American and Canadian processes, and who has been in Europe studying the question, who states that by this process of heat and pressure properly applied, peat fuel can be manufactured not only during a few months of the year, but

during the whole year irrespective of the weather conditions, and secondly, that it can be manufactured and placed on the market more cheaply than by other methods. This process is such that a plant can be installed and operated either on a large or a small scale, and therefore will not require a fortune to ascertain whether or not it is a business proposition.

I hope sufficient interest will be taken in this process at once and that if found a success it will be readily adopted and the peat fuel question solved, for the facts so far go to show that no process now in use is satisfactory.

Heretofore the great difficulty experienced in the manufacturing of peat fuel has been the getting rid of sufficient of the moisture contained in the raw material to make a suitable and commercial fuel.

After much experimenting it was found that by heat and pressure properly applied, this moisture can be removed and the residue left is the form of a firm block which is a good fuel.

This is obtained by using and charging with raw peat one or more tubes, of suitable length. These are perforated at intervals and the intervening parts are encased by steam or suitably heated sections, to heat the raw material, and weaken its numerous water cells, as it is forced along through the tubes, and by compression, break these water cells to permit the moisture and steam formed to escape through the perforations.

The raw material so far used was introduced at one end of the tube, just as it came from the bog, and by alternately charging and compressing from this end, and also heating it during the operation, the moisture freely escaped, and the product when it emerged at the other end of the tube was neat and firm.

The time required to do this was from 15 to 20 minutes, but the time required to make the finished product depends largely upon the temperature of the heated sections.

The compressing is done automatically by means of a piston, plunger, or other suitable mode of propelling at the inlet end. A hopper containing raw material is placed so that when the plunger is drawn back, the material is inserted into the tubes and is forced forward therein, and partly compressed when the plunger moves forward, and at every subsequent stroke the raw material inserted is more and more compressed until it emerges from the outlet end of the tubes, where it either breaks off by its own weight or is cut off automatically.

The product holds together well while burning, lasts a long time and gives no waste but ashes.

The process is a cheap and simple one, and should come into general use at once.

PROF. DAVIS, speaking on Item 16 on the program, said among other things: I want to say at this time, first, that I think the quality of the Journal has improved, but it can be improved more with your co-operation. I will be glad to print your views or conclusions in full. Second, I represent the now transferred Technological Branch of the United States Geological Survey; the Survey during the past year has carried out the plans announced a year ago. The educational work was somewhat extensively developed, many papers were read and publicity given to the speeches on the utilization of peat to people whose knowledge was limited. It was hoped that a bulletin would be printed but it is a difficult matter for various reasons, after a bulletin is written to get it through the press, so that the one which it was expected would be ready to distribute before this meeting, is not yet out, but in a few months every member who makes application can have a copy of it. The Bureau of Mines will distribute them free of charge. During the year there were a good many chemical and fuel analyses of peat from various states made by the Survey, and a single gas producer test, on peat from Michigan. We have not had the best of luck with peat in the gas-producers as each time we have tried a run with peat something has happened. The last time one of the cylinders in the gas engine cracked, but another one cracked with coal gas the year before, so it was not the fault of the peat gas. But it was unfortunate, inasmuch as it interfered with the test. But there was a test later and an account of that will be incorporated in a small paper to be published soon; the general results were satisfactory. The peat made good gas, ran the engine without trouble and, what was extraordinary we got serviceable gas for part of the time under rather unusual conditions. The fire kept working down in the fuel bed and finally went out. The gas producer was designed for bituminous coal and is of the down-draft type, and the fuel being on fire at the top, gas was generated at the top of the producer and was forced down through the fuel bed below. The fire in the case of this peat, instead of staying near the top of the producer after test had been on 7 or 8 hours, bored down into the fuel bed and went out at the bottom and

had to be rebuilt. As reports were received from the fuel analyses as the test went on it was found there was 57 per cent moisture in the fuel which of course explained the difficulty in keeping up the heat sufficiently to keep the fire alive. However, afterwards, the peat was used with 40 per cent. moisture and without so much boring down of the fire. The tests as to the fuel value of the gas obtained vary, but the average results show that the peat was of good quality.

As to the plans for the future under the new Bureau of Mines there is not much to say—the work will be continued as heretofore but further than to say that the work already on hand will be carried on not much can be said at this time. It is hoped the peat investigations will be continued under more favorable conditions than before after the Bureau of Mines gets fully established.

We have a paper here by Dr. Herman C. Woltereck, of the Sulphate Ammonia Company, Ltd., of England, entitled A Critical Review of Commercial Peat, its Uses and Possibilities, by Frederick T. Gissing, Charles Griffin Co., Ltd. (This paper will be printed in a later number of this Journal.—Editor).

A MEMBER: Is it practical to make gas from peat and at the same time recover a good quality of ammonia? —if so, it might be that we could rather decrease the amount of steam necessary so it would not spoil the gas for power purposes and get sufficient ammonia to pay us.

PROF. DAVIS: It is only a case of getting enough by-products to make it commercially worth while to carry on the process. It might be done in large plants, but for smaller plants I do not think it could be made to pay.

THE CHAIRMAN: From my experience I do not see why peat could not be turned into gas by the retort process.

PROF. DAVIS: You get richer gas by the retort process but it is a peculiar thing that a properly constructed gas engine on low thermal value producer-gas is more efficient that with that having high heating value, per cubic foot, so producer-gas pays better than retort gas for power purposes.

THE CHAIRMAN: My impression is that you get a low, clear gas from peat heated in a retort and the product left in the retort would be carbon or coke of high calorific value. In making ordinary city gas from bituminous coal of high calorific value they get their gas out and coke is left, which has a pretty good value as a fuel.

MR. EDGAR STANSFIELD, OTTAWA: As to retort gas from peat, retort gas or city gas is usually made from bituminous coal by heating it in a retort externally, the volatile matter being thus largely converted into permanent gas having a calorific value four or five times as high as that of producer-gas made from the same coal, whilst the fixed carbon of the coal is left behind in the retort as gas coke, a substance of considerable commercial value. A large percentage of the nitrogen contents of the coal can be recovered as an ammonium salt in this process. Retort gas could doubtless be obtained from peat, and the greater part of its nitrogen recovered in a similar fashion. But speaking from theoretical considerations and not from practical experience, I have doubts about the commercial possibility of the process; firstly because I think that only a comparatively small amount of gas would be obtained and that it would be of low calorific value compared with city gas, though doubtless higher than that of producer gas; secondly, because the residue of carbon, etc., left in the retort, peat, being non-coking, would hardly be of any commercial value. It is therefore my opinion that it is more profitable to convert the whole of the combustible matter of the peat into a producer-gas, large in quantity, though low in caloric value, rather than to employ a more costly process to merely turn the volatile matter into a small quantity of retort gas of medium calorific value, and be left with a quantity of peat charcoal for which uses would have to be devised, even though the nitrogen contents of the peat would be thus saved.

THE CHAIRMAN: Some people claim that because peat is a low grade fuel it is a low grade gas producer. I have found it is higher in caloric value than ordinary city gas; and when tried with a gasolene engine I got a higher brake power in using peat gas than in using gasolene.

A MEMBER: Have you made out what quantity of gas and refuse is obtained?

THE CHAIRMAN: Yes, I estimated from 26,000 to 28,000 cubic feet per ton which is a good deal more than you get from coal, and then the by-products recovered are very easy to get and the ammonia especially, which was what I was after.

DR. McWILLIAM: Is that correct that you got more gas than from ordinary coal?

THE CHAIRMAN: Oh, yes! There is one thing I have

not been able to find out and that is what a cubic foot of gas is. I judge it should be a cubic foot of gas at two and a half inches of water pressure, as usually delivered. But I really have not been able to find out what it is.

MR. STANSFIELD: In connection with the test on Canadian coal recently carried out for the Government at McGill University, Montreal, under the direct supervision of Prof. J. B. Porter, a study was made of the standards adopted by different authorities; it was found that these varied considerably and in many cases were not even explicitly stated. It was decided to adopt the standard of a cubic foot of gas measured moist at a temperature of 60 degrees and under a pressure equal to 30 inches of mercury. Calorific values were stated in terms of British thermal units per cubic foot of gas measured under the above conditions. It is, of course, well known that gases change considerably in value with changes of temperature and pressure, but it is not always remembered that 100 cubic feet of gas saturated with water vapor at 60 degrees will give little more than 98 cubic feet of dry gas at the same temperature and pressure. It was decided to take moist gas as the standard, as commercial producer-gas is being generally treated in wet scrubbers, etc., and assumed to be nearly if not quite saturated with water vapor when used.

THE CHAIRMAN: My experience has been that there is a lack of standards.

A MEMBER: I hope some standard will be advocated.

A MEMBER: I think the Bureau of Standards at Washington has already adopted one for the States.

THE CHAIRMAN: Are we paying for gas at ordinary atmospheric pressure?

A MEMBER: Yes, though a couple of inches to your advantage.

OTHER PAPERS RECEIVED.

Papers were received and read by title from William Eichoff, M. E., of Erie, Pa., on The Future of the Peat Industry in America, one giving a description of Colonel John Jacob Astor's Vibratory Disintegrator for Peat Gas Producers and one of Mr. Robert Schorr, Engineer, of San Francisco, Cal., entitled "The Importance of Peat for the Manufacture of Nitrogenous Fertilizers," a general discussion. These appear below in the above order.

THE FUTURE OF THE PEAT INDUSTRY IN AMERICA

(By Wm. Eichoff, M. E., Erie, Pa.)

N. B. The writer is not interested in the sale of machinery or swamp and peat land, but has tried to interest capitalists for peat utilization and has very often failed. But this failure has not discouraged him, as he is convinced that time is not so far off when we will have a prosperous industry in this country. He has made a special study of peat for the last 10 years, besides having quite a knowledge of peat production and moor culture from his earlier age, since he spent his early boyhood in a country where peat was used exclusively as a domestic fuel. In some small cotton mills it was also made use of in connection with coal to fire boilers. At that time the peat was dug in the old fashioned way by hand, with the slane, put up in heaps for drying and then carted from the bog by ox teams to the different villages and towns. It was mainly peasant's work. Railroad transportation was not in existence nearby as the bog was too remote from any railroad station. This was near Montjoie at the Hohe Venn, Germany.

Today there exist in that part of the country peat fuel plants, driven by machinery and operated on a large scale by the Prussian government, and railroad facilities. The peat fuel plant is now flourishing where 40 years ago a few laborers were digging with the slane and brown-black material in the monotonous, lonesome moss moor. Where in the spring and summer months the turf diggers were performing their daily work or in the fall women and children were picking cranberries, today the steam whistle is blown calling a number of people to their daily toil and giving them better means of living. Nice, clean little cottages are built in the neighborhood and life brought into the before deserted dark looking land.

The same conditions are found in other parts of Germany, in some, even more flourishing, since other industries, as glass works, brick yards, coke works, grew up in the neighborhood of the bogs.

It has cost the government and the people across the Atlantic a lot of money, brain and experimental work to get to the point where they have now built up a prosperous industry. The peat industry is an established fact in some European countries and is there to stay. In fact some parts of Germany peat is competing favorably with brown and soft coal even in coal mining districts, and the majority of people in our country are not aware of the fact that a great number of articles and

chemicals imported to this country have their origin in a German peat bog.

The peat industry, with its different branches, has so far been considered a failure in this country, and it seems strange that with the well known American energy, better financial resources and a more sanguine temperament than the German possesses, we should not have been able to be at least as far or even farther ahead in the development of the utilization of a material in which this great country is so rich. What is the cause of this? we are tempted to ask. The writer does not want to dwell on enumerating all the causes of failures, as they have been treated upon so often before by very able writers, especially by Mr. C. A. Davis in his excellent article, "The Peat Industry and its possibilities in America."

But I want to mention a few important ones and to show that the removal of these few cases of failure is entirely in our power. The other causes are of minor importance in the writer's opinion.

First, it is claimed that this country is so rich in other fuels as oil, gas, coal, that a demand for a new fuel was and is not in existence. This is true when we think of the states of Pennsylvania, Ohio, Alabama, Texas, Tennessee, etc., but the sources of fuel supply are decreasing annually and the demand for it becoming greater. Wood as a fuel can practically not come into consideration any more, as for some time to come the extensive use of wood as fuel is prohibitive and reforestation will not succeed for the next centuries in conquering back the place wood had as fuel in former times. The prices for fuels are increasing annually and so are transportation rates.

It is true that the quantity of other available fuels is for some time to come sufficient in some sections of America, and that it would be folly to try to compete in such sections with these fuels by installing peat plants. This would mean "to carry coal to New Castle," as the Englishman says. But on the other hand there is no reason why in countries rich in peat deposits and remote from sources of other fuel supply, peat could not compete favorably with coal in a local market. I want it strictly understood that I am writing first about localities, where convenient transportation facilities are available. And there are places where railroad and street cars run nearby or even cross the bogs. Why we are not using more peat as fuel here in our country and having peat fuel plants in operation is illustrated by the following experience the writer had two years ago. In a town not far from the writer's present residence the installation of an electric light plant was con-

templated. The town is located within one-half mile of a deep and extensive peat deposit, of an excellent quality for peat fuel. It was decided to install a hard coal gas-producer plant. The writer called their attention to the fact that they had good and large peat deposits in their neighborhood which would supply a peat gas-producer of the desired size (without recovering by-products of course), for at least 90 to 100 years, with the probability of manufacturing peat fuel to supply the town's private demand and so save on the high price of fuel and transportation. The interested party wanted to know where there was such a plant in operation, and the writer could not refer to one in this country, not even to a successful peat fuel plant. They naturally did not want to go abroad but got the information that all the peat plants in this country had failed as the peat proposition was a fake.

Now, gentleman, you all know that in Europe such successful gas-producer plants are in operation, especially in Sweden and in the northern part of Germany. But here we have the situation in a nut shell.

Before I go any further let me tell you what became of the project. The people installed a coal gas-producer plant, getting producer installation from a concern that so far has never gotten above the state of experimenting. The thing did not work satisfactorily and was thrown out to be replaced by a steam plant.

What caused the failure in this last case caused also the failure in most peat projects in this country. Instead of taking advantage of the experience of former experimenters and investigators and starting peat fuel plants according to approved and successful methods, the new promoters commenced to experiment and tried to push ahead unripe ideas, with the result that they met disaster and discouraged further investment. There are even cases where such promoters had not even the slightest knowledge of the nature of the peat which they were handling.

The writer three years ago undertook a trip through Canada and some of the Northern States, where it was boasted in technical and other papers that successful plants were in operation. Times might have changed since. The articles pertaining to these plants were not only written by promoters but by men that were sent to make reports about the existing conditions. Instead of advertising after really having the goods, promoters advertise before they had succeeded and could show the people. This is a great blunder. I was greatly disappointed, as I found not one of the five plants I visited in operation. But in all of them the practical man could see

where the leak was. I must mention here one exception. I found only one plant that showed common sense—engineering features and management—and this was near Toledo. In the the writer's opinion this plant is a success as far as general arrangement is concerned. The plant was not in operation so I cannot say anything about the press used there, but it seemed to the writer an improvement or modification of machines in use. The writer was well impressed with the peat digger in use. The plant is too near to a center of other fuel distribution and has to manufacture a considerable cheaper fuel than coal to have a paying local market and justify the necessary changes in furnaces and stoves.

Nothing is more detrimental to the progress of an enterprise than having it boasted too early and see it perishing in ruin. Such has been the case with most peat projects in this country. If we learn to adopt those successful methods of German engineers and chemists which can be modified and improved and can show the people, we will see peat fuel plants grow up like mushrooms in sections with good transportation facilities and ample deposits and in localities remote from other fuel supply sources.

It has been argued that labor in Europe is considerably cheaper, which is an important factor in handling the material. This is only true to a certain extent when we consider that our labor is also enough more efficient to offset this difference. If it was not for that fact American manufacturers could not compete in foreign countries with the products of those countries. Take for instance the manufacture of boilers, engines, locomotives, machine and pneumatic tools. Do you think the American producer is selling at a loss only to boost the stars and stripes? No, it is our better and more efficient labor that enables him to compete with his goods in foreign countries at a good profit. The writer has handled men for over 30 years in small and large bodies, in productive and operative work in factories, in large erecting and construction work and knows what he is talking about.

Good judgment in the selection of raw material for the purpose in view, adopting approved and tested methods, using successful machines, that have stood the test, good practical engineering talent, systematic management, and economy in the handling of labor to the best advantage, are necessary for a good future of the peat industry in this country. When we have used these, there is no doubt that we are able to show successful plants in the future and the industry will gain a foothold in America.

I have mainly spoken about the fuel proposition, but what

I have said is also applicable to other branches of the peat industry, such as the manufacture of dyes, paper, litter and coke. This brings me to another branch of the industry, namely, the manufacture, or better, the compressing of peat litter. It is surprising that so little has been done in this line. The finished pressed material is at present imported from Holland to this country and sold at a very high price. And this country is so rich in this raw material and the cost to manufacture the finished product practically a trifle. Most of these moss bogs, as far as the writer has found, are in the possession of farmers, but the majority of these gentlemen are all "from Missouri" and smell in every man that calls their attention to the value of such bogs, a fakir, that tries to sell him some worthless machinery. Here I think the Department of Agriculture should enlighten the farmer by publishing bulletins on "Peat as Cheap Domestic Fuel," "Peat as Litter," etc., and distribute them amongst the farmers just the same as it publishes all the other excellent and instructive bulletins. Such a step would also greatly help to the development of the peat problem. Our farmer has more faith in these messages from our government than when persons interested in the sale of machinery talk to them. In the agricultural colleges lectures should be held on the cultivation and drainage of peat, moor and swamp land, as is the case in Europe. It would be a more profitable field to enlighten the growing generation on these subjects than on aerial navigation. There is great need for a Government Experimental Station, which certainly would be of great national importance.

In recent years it has been discovered, especially through the highly scientific research of Professor Caro and Dr. Franke Charlottenburg-Berlin, that gas produced from peat, when by-products are recovered, is of superior quality to that produced by good coal. It is claimed that when this gas is used for the operation of gas engines and the power of this engine turned into electrical energy and current supplied to environs of 100 miles or more, enough of the by-products, especially sulphate of ammonia, can be obtained to pay in a short time not only for the cost of installation of such a plant, but also the cost of operating the same, so that the selling of the current is all profit.

Experiments on a large scale have been made and are being conducted now in Germany under Dr. Caro's and Professor Franke's directions. The writer is informed that the results are coming to what these authorities claimed. If this is so, and there is no cause of doubt, the peat question will step into entirely new channels in this country and we shall have in a short time such installations going up here aside from the great

water power plants, and these peat plants will be a more profitable proposition than water power.

Many difficulties heretofore encountered will be removed, such as transportation troubles. Peat bogs remote from railroad or other transportation facilities could be profitably utilized, an economic controllable system of drainage, which is a very important factor, can be obtained at least cost, cheaper handling of raw and finished material obtained, and last, but not least, the waste heat obtained could be used for drying purposes and a salable product manufactured for domestic use in a local market.

We see that the future outlook for a prosperous and profitable new industry is bright, but in going ahead in this great work let us not forget that economy, right from the beginning, is the only road to success. Use only successfully proved methods, so that the partially lost confidence in peat is reestablished; make every work that you have to do pay for itself, if possible, in some way or other. For instance, if timber has to be removed, let the timber pay for this work; if possible, with a profit. The peat removed for transportation or drainage channels should be converted immediately into gas and by-products to pay for this work with a profit. The land not under work should be cultivated and such fruits and vegetables raised on it that grow in a peaty soil. The land worked out should also be used for agricultural purposes or reforestation, or ponds and water accumulators in the controllable drainage system used to run small turbines and motors, or they can be used for fishery purposes, and duck raising. It should also be considered that many peat bogs are fit for regeneration and in such way an early exhausting of supply be prevented. There is no doubt that in time the peat industry will be a competitor of the oil industry.

As the conclusion of this paper, let me call attention to a little matter, but it is very important for peat machinery manufacurers. A friend of mine, representing some mining and machinery interests, visited South America last year. He stayed there for about eight months, traveling through Brazil, Venezuela, Paraguay, Uruguay, Argentine Republic, and around the Horn to Chile and Peru. He told me that peat is used as fuel in Argentine and Paraguay and that he even saw peat dug as far as the Falkland Islands with German machines. I have no doubt that this is true, as I always found this man trustworthy, and especially when we take into consideration that South America has found so far very little other fuel than wood.

COL. J. J. ASTOR'S VIBRATORY DISINTEGRATOR.

An Ingenious Device Which Manufactures Producer Gas from Peat and the Patent Covering Which Will Be Given to the Public.

(From the Scientific American, May 22, 1909.)

Col. John Jacob Astor, of New York City, has appeared more than once as an inventor of practical and useful devices on the Patent Office records. He has devised and patented in past years an ingenious bicycle brake, a novel pneumatic road improver, and an efficient marine turbine, the patent covering which last invention he gave to the public. Colonel Astor's latest invention is a means for practically and successfully utilizing as a fuel for power the vast deposits of peat found in this country and in other parts of the world.

The economic utilization of the enormous peat bogs found throughout the temperate zone has been a problem baffling scientists and engineers for a great many years. Attempts at reclaiming the peat bogs to make arable farm land have met with partial success in Norway and Sweden. Peat has been successfully used as a fuel, but due to the large amount of water contained in the peat, it is necessary to dry it for a long time before it can be burned.

Peat constitutes a fairly serviceable fertilizer; but due to the large amount of tannin, organic acids, iron salts, and gases contained in the peat, it is necessary to cure it by long exposure to the atmosphere before it can be applied to the soil. The tannin and organic acids in the green peat act to kill and retard vegetable life rather than support it.

In Sweden attempts have been made to manufacture producer gas from peat, but these attempts have met with poor results, while the experiments made in this country have been unsuccessful. Inasmuch as the peat contains a considerable quantity of water and the solid portions are almost entirely carbonaceous, it is better adapted in some respects for the manufacture of producer gas than is bituminous coal. Ordinary peat is of a very porous and loose texture, and a great deal of gas is occluded among its fibers. It has such poor heat-conducting qualities that, when heated in a producer, a portion of the peat will be completely burned without heating other portions to any material extent.

The vibratory disintegrator which has been invented by Colonel Astor and which, it is believed will solve the problem of the commercial manufacture of producer gas from peat, utilizes the expansive force of the air and gases within the very

porous peat to disrupt and disintegrate the latter, and to permit the peat to be thoroughly and uniformly heated. The gas generated may be supplied to an ordinary internal combustion engine, the engine muffler being placed inside the gas producer. The sides of this muffler are thin, so as to permit them to be distended and drawn inwardly upon variations in the pressure within the muffler. The edges of the muffler may be fluted, corrugated, or accordion plaited, to facilitate this relative movement of the opposite sides, and one end of the muffler is connected to the exhaust pipe. The gas escaping from the engine cylinder after each explosion in the latter tends to expand the muffler, and as the exhaust gas escapes from the muffler, the sides will again contract. These vibrations of the side walls of the muffler cause the successive compression and expansion of the gas within the gas producer, and likewise the gas included in the pores and interstices of the peat. As a result, the cells and pores contained in the peat are disrupted, and the peat is broken up and disintegrated.

To further aid in breaking up and disintegrating the peat and permit of its uniform heating, the peat chamber of the producer is supported from the engine frame or base, so that the jarring or vibration of the engine frame is transmitted to the peat.

Any suitable form of gas engine may be employed, but preferably one running at comparatively slow speed, so that the successive charges of exhaust gas will have time to produce the desired expansion in the muffler. Preferably, an air-cooled engine is employed, and the air utilized in cooling the engine cylinder is delivered in part or in whole to the base of the producer.

Inasmuch as peat can be obtained by the farmers in many sections of this country for the mere trouble of digging the same, it is evident that producer gas could be manufactured at a very low cost. This would permit the farmers to drive various kinds of farm machinery by gas engines, to illuminate and heat their homes, and give them a very valuable fertilizer for their impoverished soil as a by-product in the peat residue.

Colonel Astor is now erecting a peat-fuel producer-gas plant at his country place at Rhinecliff on the Hudson, in which the vibratory disintegrator will be given a practical test. The plant, of about 150 horse-power, is to run a stone crusher; and if the peat yields its gas, as it is confidently believed it will, it will mean an engineering advance that may have very far-reaching results.

The patent application is now pending, and on its being allowed, Colonel Astor intends to present it to the public, in the hope that it may be of wide general use.

THE IMPORTANCE OF PEAT FOR THE MANUFACTURE OF NITROGENOUS FERTILIZERS. A GENERAL DISCUSSION.

By Robert Schorr, Engineer, San Francisco, California.

The whole world, including the air, is being scoured for nitrogen, prompted by the probable exhaustion of the Chili nitrate deposits within 40 years, and prompted also by the rapid increase of population and the gradual impoverishment of our soil. The world's population is estimated at 1,550 millions, and it will be of interest to ascertain the probable increase at the end of 40 years, i. e., the probable number of inhabitants in 1950. Reliable statistics upon this subject are available only for the more important European countries with 300 million people, out of a total of about 395 million. These countries showed between 1891 and 1900 a surplus of birth over death equal to 35 million, or 11.66 per 1,000. Germany's yearly increase in population has been .58 per cent. in 1870, 1.07 per cent. in 1890 and 1.5 per cent. in 1900. Since that time it has remained almost constant, as the emigration has been only from 28,000 to 40,000 per annum. Should this rate be maintained Germany will have doubled its population in 46½ years. The gain in the U. S. from 1900 to 1910 will be probably 14 million, or 18.5 per cent, mainly due to immigration. Russia has a slightly higher birth-rate than Germany, but its increase has been only 1.1 per cent. per year, due to heavy emigration. I believe it will be entirely safe to assume for the whole world an average yearly increase of 1 per cent, and then we have $K=kp^{40}$ or, log. K=log. 1550+40 log. 101 hundredths=3.3628 or K=2306 million people after 40 years. This means that additional 756 million will have to be fed by 1950, when more than ½ of the present nitrogen-supply (Chili-Salpeter) will not be available any more. For K=2k we get n=69.7 years for the doubling of the earth's population, if the yearly increase is 1%. These are serious figures, which will not be very far of the truth. With the spread of civilization the per-capita consumption of farming products has increased in every line, cereals leading with 480 lbs. As an illustration of the quantities of ingredients withdrawn from the soil by the crop I will quote from the American Fertilizer, Philadelphia, December, 1908: "The draught upon the soil by 200 lbs. of sugar beets amounts to from 3 to 5 lbs. Nitrogen,

" 1 to 3 lbs. Phosphoric Acid,
" 6 to 8 lbs. Potash,
" 1 to 1½ lbs. Lime,
" 1 to 1½ lbs. Magnesia.

Last year's beet-crop must have been between 50 and 60 million tons, as over 6¾million tons of beet-sugar have been consumed,— against 50,000 tons in 1840. The per capita consumption of cane and beet-sugar has risen from 3 lbs. in 1840 to 20 lbs., Great Britain leading with 92 lbs., followed by the United States with 81 lbs. and Germany with 42 lbs. It would lead too far to give further data; I only desired to indicate the enormous growth of requirements.

Our present supply of purely nitrogenous fertilizers is made up as follows:

1. Chili-Salpeter, Sodium Nitrate, $NaNO_3$; total exportation in 1909 about 2,000,000 metric tons; 85 per cent of these utilized in agriculture=1,700,00 tons with from 94 per cent to 96 per cent $NaNO_3$, say average 95 per cent= 19.04 per cent NH_3=15.6 per cent N.....265,000 tons N
2. 900,000 to 1,000,000 metric tons Sulphate of Ammonia, $(NH_4)_2SO_4$ average "Commercial" =24.5 per cent NH_3=about 20 per cent N...200,000 tons N
3. Cyanamides of every form, present annual capacity of plants 170,000 tons; from 9.5 per cent to 20 per cent N, say 13 per cent N at an average ..... 22,000 tons N

1.=54.4 per cent of total; 2.=41.1 per cent and 3.=4.5 per cent of total=100.

Total .....487,000 tons N

This is the present N-Supply, exclusive of mixed fertilizers, which contain from 2 per cent to 10 per cent of nitrogen, and without these we have a per capita consumption of about .7 lbs. of N. If conditions were the same in 1950 we would require, then, over 725,000 tons of N, which will have to be furnished in the shape of ammonia or cyanamide products mainly.

For our discussion the sulphate of ammonia is of predominant importance. The production of this salt has almost doubled since 1902. The sources of the sulphate of ammonia supply are:

1. By-Product-Coke-Plants furnished in 1909 about.500,000 tons
2. Gas Works furnished in 1909 about.....250,000 tons
3. British Iron and Shale Industry furnished in 1909 about ..... 75,000 tons
4. Gas Producer Installations furnished in 1909 about ..... 75,000 tons

Total .....900,000 tons

The production of the United States in 1909 was 106,500 short tons (equivalent $(NH_4)_2SO_4$). Of this amount 75,000 tons came from coking plants. The importation was 40,192 tons.

The maximum amount of sulphate of ammonia which could be obtained from these sources under ordinary working conditions would be:

1. Assumed that the total world's production of furnace-coke=80 million tons would be made in by-product coke ovens with an average yield of 70 per cent coke and 1 per cent Sulphate of Ammonia. 115 million tons coal.....	1,150,000	$(NH_4)_2SO_4$	
2. About 90 million tons of coal used for Gas-making, average recovery .8 per cent Sulphate of Ammonia.....	720,000	"	"
3. British Iron and Shale Industry, as before	75,000	"	"
4. Add for Producer-Gas-Installations, (estimated)	275,000	"	"
Probable Total	2,220,000	"	"

Equivalent to about 444,000 tons of Nitrogen.

The possibility of recovering ammonia in oil-distilling and in the making of oil-water-gas has been omitted. This would be a comparatively small item, even if the whole world's oil output were considered. The same was about 40 million tons last year, and the nitrogen fluctuates between .1 per cent to .5 per cent.

We have seen that we cannot supply all necessary nitrogenous fertilizer in the shape of Sulphate of Ammonia even under favorable conditions. A keen rivalry will develop between this material and cyanamides when the deposits of Chili Salpeter are exhausted. The manufacture of the last named fertilizers requires very considerable investments, due to large power requirements, and it is quite probable that sulphate of ammonia will offer better commercial possibilities.

Our present sources are inadequate and the indications are that they will not suffice in 1950 either. For that reason it will be of interest to investigate what could be accomplished in that connection by using peat. A great deal has been published regarding the Mond, Ziegler, Frank-Caro, Woltereck and other processes. Dr. Otto Zwingenberger has also given us an excellent paper, which has been printed in this Journal of January, 1910. His introductory remarks are of particular interest, and they should be carefully considered.

While there may be close to 350,000 square miles of bog-land in the world, I have assumed only 200,000 square miles to be utilized. See this Journal of January, 1909. Each acre-foot contains about 130 tons of dry peat substance, and 1 acre of a little over 7 feet in depth has 1,000 tons=to 640,000 tons per sq. mile, making 128,000 million tons for the 200,000 sq. miles. This may be a conservative estimate, as many peat-bogs are over 30 feet deep. The dry peat has from .7 per cent to 3 per cent of N, generally however, between 1.75 per cent to 2.5 per cent, and an average of 1.75 per cent may not be far from the mark. In that event we have a store of over 2,200 million tons of N, equivalent to about 11,000 tons of Sulphate of Ammonia with 25 per cent NH_3. For the Mond process a recovery of 70 per cent of N present in the fuel is claimed, which would make 7,700 million tons available. Present quotations are $54 per short ton f. o. b. New York and, if we assume $40 at works, we reach the enormous total of over 30,000 million dollars. The practical side of this subject, however, is rather complex. Early experiments, which have been made by Foster and Winkler, proved that the yield of ammonia is greatly increased by passing steam into, or over the heated fuel. By doing so they increased the recovery of N (as NH_3) from 14.5 per cent. to 62 per cent in one case. In coking coal in by-product coke ovens only from 14.3 per cent to 16.6 per cent of the N in the fuel is obtained by saving the ammonia. Most bituminous coals have from 1.3 per cent to 1.5 per cent N, and the recovery is generally from .24 per cent to .28 per cent N, or .267 to .34 per cent NH_3, corresponding with about 1 per cent to 1.3 per cent of sulphate of ammonia. In Gas-works and in Coalite making the return of .8 per cent is general. In the Ziegler process of peat carbonization only .4 per cent of sulphate of ammonia is made, indicating a recovery of only 5 per cent, or less, of the nitrogen content of the peat. The best results are obtained when lime is used to bind the "fixed" ammonia; with steam alone, or in the case of direct acid-absorption, the yield is usually smaller. The new German process (Pat. Burkheiser) aims to save the sulphur of the fuel also by passing the tar-free gas through brown iron stone ($H_6Fe_4O_9$) and making SO_2 for ammonia-binding, instead of using sulphuric acid in the ordinary way. This process is still in its experimental stage, and it may never become a commercial success, due to the difficulty of preventing SO_3-formation. The sulphur, however, could be certainly saved in carbonizing plants of every description, and acid could be made thus locally.

The reason for the small N-recovery in coking lies mainly in the sensibility of NH_3 to heat and, to prevent its breaking

up into H and N, it is essential to have low temperature and high velocity of gases. The recovery is also generally lower with fuels high in O, i. e. with young carbonacous deposits.

In the usual practice of by-product coking from ½ to 1 lb. of steam is used in the ammonia stills per 1 lb. of coal coked, which is approximately from 2.5 to 5 lbs. of steam per 1,000 cu. ft. of gas. From 40 to 100 lbs. of lime and 1 ton of 60° Be', or 1¼ tons of 50° Be' sulphuric acid are employed per ton of sulphate of ammonia. The theoretical requirement of acid is 74 per cent C. P.; 60° Be' acid contains 78 per cent H_2SO_4 and is equivalent to 124.86 of 50° Be'. The cost of general labor and of sacking the salt is from $3 to $7 per ton. This item, as well as the "fixed charge," is rather uncertain, because the installation serves also to recover other by-products, and it is often a matter of opinion how to segregate the charges.

The steam consumption in Mond Gas Plants is about 2.5 lbs per 1 lb. of fuel carbonized, and about 3 lbs. of air are used with the steam, both superheated to 250° C or 482° F. This is a very serious thermal item, and particularly so when low-grade fuels are handled. Then the power aspect becomes of less importance and the whole proposition is operated primarily as a chemical plant. The total heat requirement for the Mond Gas installation is made up as follows:

Assumed: air-temperature 60° F, mean specific heat of air .24; steam of 120 lbs. pressure superheated to 500° F specific heat c=.50. Total temperature-drop of gas (from actual experience) 500° C to 55° C. Mean c=.36. Furthermore we assume that ½ of the heat carried by the warm circulating water is utilized in the plant. 4 gallons or say 30 lbs. of cooling water per lb. fuel, discharging at 75° C (167° F) and returned at 40°C=104° F.

3 x .24 x 440 = 317 B. t. u.	
2.5 x 1184 B. t. u.=2960 B. t. u.	
2.5 x .5 x 160 = 200 B. t. u.	
3477 B. t. u. at 90 per cent efficiency	3860 B. t. u.
30 x 30 x 1=half of heat of cooling water.	900 B. t. u.
	4760 B. t. u.
less sensible heat taken from hot gases 3.5 x .26 x 800=768 say=	760 B. t. u.
Total heat-requirement per 1 pound of fuel, about. . .	4000 B. t. u.

These figures illustrate the large heat-expenditure necessary for fuel-distilleries of every description, which aim to re-

cover the largest possible amount of ammonia. They also indicate that very little will be left for power purposes in the case of carbonizing low grade fuels. We have established a heat consumption of 4000 B. t. u., exclusive of pump and exhauster duties. These items are governed by the size of the installation and by the grade of machinery employed for the purpose. Generally about 1.5 per cent to 4 per cent of the fuel is required, if good coal is used, or about 200 to 500 B. t. u. Consequently it will be necessary to allow approximately 4,000+500=4,500 B. t. u. per 1 lb. of air-dried peat, containing from 25 per cent to 30 per cent moisture. Such a peat has from 6,000 to 7,000 B. t. u. per lb., depending upon its composition, say 6,500 B. t. u. In a good generator it will be possible to reduce losses due to radiation, use of coke in starting, due to unburned fuel, etc., to 10 per cent (i. e. for the generator, exclusive of coolers, etc.) which would make in our case 5,850 B. t. u. in the uncleaned gas. The heat-units in the tar will be from 7 per cent to 10 per cent, and more, depending upon the temperature employed and water used, so that about 5,400 B. t. u. will be available, if the tar is not burned. For this purpose, however, it will be too valuable in most of locations. As 4,500 B. t. u. are required by the installation, only 900 B. t. u. are available for other purposes, equal to about 14 per cent of thermal efficiency. There are many arts where "good efficiency" and "good commercial results" are at wide divergence. The investigation shows the impossibility of treating the subject narrowed down to one scope. It is absolutely essential to consider the proposition as a whole, with all by-products made. We know that the few peat-carbonizing plants in existence make parafine, creosote, gas, oils, etc., from the tar, and from the tar-water and gas they recover ammonia, acetic acid and methyl alcohol, marketing either sulphate of ammonia or ammonical liquor, besides acetate of lime, alcohol, etc.

In closing I wish to say a few words regarding the Woltereck process of "moist combustion," which permits of using peat with 65 per cent to 75 per cent of moisture. A blast of air, charged with water-vapors at a regulated temperature is introduced into the retort, and for that reason "wet combustion." The resulting gases contain tar, acetic acid and ammonia as usual, but the chief aim of this process is the making of sulphate of ammonia. The ammonia is absorbed by hot sulphuric acid, after the gas has been cleaned from tar, and after the acetic acid has been absorbed in the lime-towers. Woltereck claims an average recovery of from 5 per cent to 7.5 per cent of sulphate of ammonia, containing in some cases more N than available in the raw peat. The excess amount of N he claims to be due to a partial destruction of the air, which,

however, is impossible. To effect the same, and to assure the combining of N with H without electric current, would require very high pressure (about 3000 pounds per square inch) and the presence of Uranium as has been demonstrated by the new process of Professor Franz Harber of Karlsruhe. The pamphlet of the Sulphate of Ammonia Co., L't'd., London, (Woltereck) contains very incomplete information, and the same must be said unfortunately also about all contributions, which have been made pertaining to peat carbonizing plants. There is no doubt, however, that the handling of peat propositions on such lines is very promising, while their exploitation for power purposes alone has been generally greatly overestimated, as I have outlined in my paper, "Commercial Aspects of Gasifying Peat," Journal of the American Peat Society, January, 1909, pp. 94 to 107.

THE CHAIRMAN: This concludes our business and it is to be hoped we will all meet again in Kalamazoo next year.

The meeting was then declared adjourned.

NEW PROCESS FOR PREPARING PEAT AS FUEL.

All Moisture Extracted Therefrom at Small Expense.

Consular Agent John B. Brewer, of Wiesbaden, furnishes the following information concerning the invention of a German engineer which, it is claimed, will make peat "the ideal fuel:"

At a time when the superiority of oil as fuel for seagoing vessels is eagerly discussed and tested, there has come to my notice an invention regarding the production of a new fuel which seems destined to play an equally prominent part in industrial as well as in domestic life, and to form an important chapter in the problem of the preservation of the natural resources of the United States.

A civil engineer, having his experimental plant in this district, has found and patented a very simple process of extracting, at little expense, all water from peat, of which inexhaustible quantities are found the world over; inexhaustible because of the continuous and steady growth of new peat formations after exploitation of the old.

Knowing that millions of dollars had been spent in the past for the purpose of completely extracting water from peat on a large scale by powerful pressure, as well as by electricity, my attitude toward the new claim was rather skeptical for

some time, and therefore I hesitated to report thereon until I had consulted scientists and experts and until the experiments and tests made before me personally had convinced me of the value of the discovery.

The briquettes made from the material so treated furnish a fuel which appears far superior to the best coal, as to caloric power, low price, small specific weight, and absence of all smoke and ashes during and after combustion.

The freeing from water is accomplished by the admixture of peat-coke to the peat before pressing in the proportion of 1 to 15. As no extraneous substance is used, there is complete independence from other ingredients. The pressing proper is done by specially constructed and patented machinery of a simple kind. As the three main elements of peat are carbon, hydrogen, and oxygen, the process of combustion leaves hardly any ashes, and must seem ideal, since peat contains neither sulphur nor phosphorus nor any other ingredient to which the ordinary smoke nuisance is due.

CANADA'S EXPERIMENTAL PEAT PLANTS.

By A. R. Maujer.

The best condensed account of the plants of the Dominion Government, which has come to the notice of the Editor is that given below. It appeared in "Power and The Engineer," Vol. 32, No. 37, pp. 1628-1631, and the original is illustrated with halftones not reproduced here. The article is written from the engineering point of view and is the more valuable on that account.—Editor.

The coal deposits of Canada are all located in the western and eastern portions of the country; practically no coal is found in the central parts. The anthracite which is used in the central provinces is obtained from the Pennsylvania district. Due to the cost of transporting it such a great distance the cost is high. In Ontario and Quebec anthracite of very ordinary grade costs $7.50 per ton; in Manitoba the cost is as high as $10. For these reasons a satisfactory substitute for coal which could be made to compete with it commercially would find a ready market.

Peat, which is found in great abundance through Canada and the United States, is just such a substitute. Doctor Chalmers, of the Geological Survey of Canada, has estimated that there are considerably more than 37,000 square miles of workable peat-bog land in Canada. The depth of the bogs varies from 5 to 10 feet. This estimate is based on investigations

which have approached thoroughness only in the territory east of Lake Superior. Throughout the western section of the country vast areas exist which have not been investigated but which undoubtedly have immense peat deposits.

Numerous attempts to manufacture fuel from peat have been made from time to time in various parts of Canada. None has proved entirely successful. The long succession of failures has served to discourage further efforts. The Canadian Government, recognizing the economic possibilities in a thriving peat-fuel industry, is endeavoring to stimulate the interest and enterprise of bog owners and manufacturers by demonstrating that peat fuel can be produced cheaply and that power for industrial purposes as well as heat for domestic use can be obtained therefrom. To accomplish this a portion, comprising about 300 acres, of what is known as the Alfred bog has been acquired and fuel is being manufactured. The peat is used at the fuel-testing station in a peat producer-gas plant of 60 horsepower capacity. The bog is situated about 40 miles east of Ottawa in Prescott county, province of Ontario. It covers an area of approximately 6800 acres. The peat varies in depth from 3 to 17 feet.

That the peat is suitable for fuel is shown by the following analysis which is given in Bulletin No. 4 of the Canadian Department of Mines.

ANALYSIS OF PEAT.

Absolutely Dry.

	Per cent.
Volatile matter	68.23
Fixed carbon	26.00
Ash	5.77
Nitrogen	1.76
Sulphur	0.218
Phosphorus	0.033
Calorific value in B.t.u	9005.000

Before actual manufacturing operations were started at the Government bog about 24,000 linear feet of drainage ditches were run late in the summer of 1909. This required the excavation of about 9300 cubic yards. The excavating was done entirely by hand, and cost approximately 8½ cents per cubic yard.

While the ditches were being dug an Anrep peat machine, together with other machinery and equipment, was purchased, brought to the Government bog and made ready for operations which were started in the summer of the present year. The machine has a capacity of about 30 tons per day.

The manner in which the peat is dug and handled is as

follows: The men work at different levels so as to secure uniformity in the composition of the peat after it has passed through the machine. The peat is dug out with large sharp-edged spades and thrown onto the elevator. At the upper end the peat falls off into the hopper of the mixing machine in which all roots and stems are cut into small pieces and the peat is so thoroughly mixed that it resembles a pulp when it emerges. The cutting is accomplished by a number of knives mounted on a shaft which revolves at a speed of about 260 revolutions per minute. These knives pass sets of stationary knives which are fixed to the interior surface of the casing. A number of broad helix-shape blades mounted on the same shaft, do the mixing and force the peat out of the mouth of the machine onto a belt conveyor. The peat falls from the end of this conveyor into small steel dump cars which are hauled to and from the drying field by an endless cable. The cars travel on light portable steel tracks which are laid down on the roughly leveled surface of the bog.

The upper of a pair of jaws attached to the truck of the car is raised and lowered by a cam and weighted lever. When the upper jaw is raised the cable rides on a grooved roller mounted on a spindle in the middle of the lower jaw and does not come in contact with either jaw. When the lever is thrown over the weight holds the movable jaw down and the cable is firmly gripped. The boiler and engine are built integral with each other and are made as light and compact as is consistent with durability. The rated capacity of the engine is 35 horse-power. The boiler is fitted with a grate suitable for burning either peat or brushwood. The entire outfit is mounted on a steel frame which is carried on car wheels. When it is necessary to move the apparatus, it is warped along over ordinary steel rails by means of a cable which runs through a pulley attached to an anchor and is wound over a slowly moving geared drum on the machine.

When a car full of peat arrives at the drying field, one man disconnects the grip and dumps the peat from the car into a Jakobson field press which travels along at the side of the tracks. The press consists of a wooden frame the front part of which travels on a wide wooden roller. The peat is roughly spread out on the ground within this frame by two men. The rear part of the frame is covered. Under the cover there is another wide wooden roller. This roller is set about 5 inches above the surface of the ground and is rotated by the front roller to which it is connected by chains located at the sides of the frame. The roller and frame press the peat out into a smooth flat strip about 6 feet wide and 5 inches deep. The

back of the frame carries a set of 14 wooden knife blades which are held down by as many weights. The knives divide the strip of peat into 15 ribbons of equal width. These are cut crosswise into lengths of about 12 inches with suitable circular knives by the man who empties the cars. The object of cutting the peat up in this way is to hasten the drying by exposing more surface to the air. The press is slowly dragged along at the desired rate by a cable wound over a drum at the engine.

The peat is allowed to lie undisturbed for seven to ten days or longer, depending upon climatic conditions, until it is firm enough to be turned. After it is turned the peat is allowed to remain on the drying field for about ten days longer. It is then stacked. Each slab is spaced an inch or two away from its neighbors so that air may circulate through the stack and the drying process continue. The peat which is to be carried in stock for any length of time is removed from the stacks after about 30 days and placed in the storage shed. The storage shed is of cheap, wood construction, 160 feet long, 22 feet wide and 18 feet high. The first small house beyond the shed is the blacksmith's shop; the second is the office.

Thirteen men and three boys are required to dig, machine and spread the peat. The men are paid $1.75 per day and the boys $1. This makes a total cost of $25.75 per day to lay the peat down on the drying field. At the rate of 30 tons per day the cost per ton is about 86 cents. The cost of turning the peat is 7 cents per ton and the cost of placing it in stacks is 25 cents. It costs 20 cents per ton to place the peat in the storage shed and 25 cents to load it from here into freight cars. This makes a total cost of $1.63 per ton for digging, spreading, handling and loading the peat for transportation. To this must be added the freight charges, the interest on the investment and the amortization. These items cannot be estimated from the data at present available. It is believed, however, that these will not cause the cost of the peat to become so great as to eliminate it from competition with coal at $7 or more per ton.

The Canadian Government will keep all of the peat that it requires for testing purposes and sell the rest at a suitable price.

Fuel-testing Station.

The Government fuel-testing station is located in Ottawa on Dolly Varden and Division streets. It was erected during the summer of 1909. At present the plant is equipped for testing peat fuel only. The apparatus consists of a Korting double-zone suction gas producer, the necessary purifying apparatus, a Korting gas engine and a 50-kilowatt Westinghouse

direct-current generator. The producer room is large enough to hold additional apparatus and producers of other types are to be installed in the near future. These producers will be especially designed for bituminous coal and lignites. The producer is 15 feet high, 2 feet 9 inches wide and 5 feet long.

The gas-cleansing apparatus consists of a wet tar separator and a coke scrubber.

The engine is a single-cylinder, four-stroke-cycle machine, fitted with a throttling governor. The diameter of the cylinder is 15 inches, the stroke is 24 inches. The speed is 200 revolutions per minute. The air supply for the engine is obtained from the interior of the engine room through a brick duct built against the wall. With this arrangement the temperature of the air supply remains practically constant throughout the year. During tests the current generated by the dynamo is absorbed by either the bank of five hundred 16-candle power incandescent lamps, which is located on the end wall of the room, or by the iron gird.

When the producer is started up, suction is furnished by a small centrifugal exhauster belted to an alternating-current motor. Current for the motor is obtained from the city-lighting company's mains. The engine is started with compressed air.

The gas-testing apparatus is located on the right wall of the engine room. Gas is drawn from the system by a small Root blower and passed through a water-pressure regulator to a Junker gas meter. From the meter the gas goes to the calorimeter which is also a Junker instrument. The average effective heat value of the gas is about 126 B.t.u. per cubic foot. The producer requires from two and one-half to three pounds of peat per brake horsepower per hour. The plant has been in actual operation for such a short time that no specific data in regard to the cost of operation and the performance of the apparatus are available at this writing.

We acknowledge our thanks to Dr. Eugene Haanel, Canadian Director of Mines, for permission to obtain the material for this article. Much of the data relative to the peat-fuel manufacturing plant of Alfred was supplied by Aleph Anrep, peat expert for the Canadian government. Information relative to the fuel-testing station was secured through the courtesy of B. F. Haanel, chief engineer of the fuel-testing division of the Department of Mines.

PEAT MACHINERY AND PRODUCTION OF PEAT.

By J. H. Van Glahn, Toledo, O.

(Continued from last issue.)

The material to be dried is automatically fed into the machine by means of a screw conveyor at the head, which leads the material to the bottom of the outer drier shell, where it is taken up by carriers and dropped through the current of heated air on the inner shell or drum, in the center of the drier, which, by revolving, drops it again into the bottom of the inner shell. The operation is repeated until by the inclination of the machine, the material is carried to, and discharged at, the rear end. During the operation, the material is constantly dropped through the current of heated air, which travels from the discharge, or dry end, of the machine, to, and out through, the fan at the head, or wet end, when the moisture is expelled by an exhaust fan. The peat now leaves the drier in a suitable condition, ready for the tempering machine, where it is prepared for the press, if intended for fuel purposes.

Certain colloidal, or glue-like, substances, are developed during the tempering process; the tempering acts to contract the material and cement the whole into a water-proof mass, when compressed into briquets. The object of tempering the dry, hot material is to thoroughly crush all the constituents into a homogeneous mass, which renders it plastic and suitable for pressing, when dry. If the peat is to be made into a fertilizer filler, the tempering process is omitted.

We have in our tempering machine an ideal arrangement for treating and preparing the material for the press. In designing the tempering machine, the inventor has taken into consideration the necessity of such a machine, as well as the needs of properly preparing the material for the press. Peat improperly prepared cannot be successfully compressed into dry briquets, without intense pressure, while properly prepared peat can be compressed with a minimum pressure and a quick operating machine.

The Peat Press.

This machine is designed and built especially for the peat industry. In the simplicity attained in its construction, together with the combined elements of durability and strength, the inventor has developed, in this particular machine, the highest merit of perfection. This press is built with few parts, is self-contained in a single iron bed plate, and is compact throughout.

The mold table is circular in form and cored throughout,

and the plungers and molds are heated with steam, to prevent the material from sticking to the plates. The dies having descended into the molds a predetermined space, and the molds having been properly filled from the feeding device, the machine in operation compresses three briquets with each successive movement of the index mechanism. A pressure is brought to bear upon the briquets, the power being transmitted from the bottom by means of a powerful lever, fulcrum and crank combined, with elements of specially designed transmission gears.

This press retains to the fullest extent, all of the advantages of its special construction with reference to requirements of peat briquetting, and in it will be found new features, which cannot fail to commend themselves to any investor.

Attention is called to the feed mechanism for filling and pressing the material into the molds, the method of indexing the mold table, and for ejecting the compressed briquet from the molds, and to the general simplicity of construction of the machine throughout; the simple feature of heating the molds and plungers with steam is especially essential in making peat briquets. An open mold is 3¼ inches wide, 10 inches long and 7 inches deep, containing 228 cubic inches of material when filled. Tempered peat weighs one-third ounce per cubic inch; the compressed briquets are 3¼ inches wide, 10 inches long and 3 inches thick and weigh approximately 4¾ pounds each; the mold table makes six revolutions per minute and the plunger compresses twelve briquets at each revolution of the table, making 72 briquets per minute, and 43,200 briquets per day, equivalent to 103 tons of marketable fuel.

The machines herein described are being built in Toledo, Ohio, under the direct supervision of the writer, who is also the original designer of these machines. All of these machines are now ready for installation except the briquetting press, which is nearing completion. These machines are built for the Peat Products Co., of Lima, Ohio, and will be installed at Lakeville, Ind., where the company has under lease about 1,500 acres of fertile peat bog, located on the Vandalia Railroad, operated under the Pennsylvania system.

It will require about a 75 H. P. engine to operate the entire plant, and about 150 H. P. boilers to furnish the necessary steam for the plant and drying purposes. The total expense of operating the entire plant, including fuel, will be about $41.00 per day. The plant is designed to turn out about 100 tons of marketable fuel in ten hours.

The machinery herein described is simple and efficient; the process is automatic throughout and is known as the "Dry

Process." The writer is a practical mechanic and designer of machines, has installed and operated large manufacturing plants of various kinds, and has devoted three years to the study and development of peat products.

SOME FLORIDA PEAT PLANTS.

By Robt. Ranson, St. Augustine, Florida.

(Continued from last issue).

We dredge to a depth of about 14 feet, and after first depositing the sod on one bank, we lay up the peat on the opposite bank. After it has partially dried, we come along and lift it off the bank onto a lighter, having probably lost about 10 or 15 per cent. of its original moisture; we then carry it to a long platform about 150 feet long by 25 feet wide, and unload it mechanically onto this platform. Along the center the entire length runs a 16-inch conveyor belt and this carries the peat steadily along and drops it into a pug mill, where it is thoroughly ground and macerated. It does not take out any of the moisture, but does take out the air and makes it into a sticky, homogeneous mass. On emerging from the pug mill it drops onto a conveyor belt and is carried up an incline about 125 feet long and then dropped into the ground; there it is spread out by a spreader hauled to and fro over a radius of about 300 feet by a small hoisting engine which runs on a semi-circular track and is moved ahead as fast as each layer is spread between the dump and the outer edge of the circle. It is spread about eight inches deep and rapidly dries and cracks both lengthwise and crosswise, and in about a week is down to 40 per cent. moisture. It is then turned over by hand, each man turning about 20 tons a day, and after about another week, is down to 30 per cent.; it is then loaded on small cars running on movable track and put in the storage shed for final drying, if wanted for fuel, and if for filler it is run through a coarse crusher and passed into the driers, where it is artificially dried to 10 per cent. moisture, screened through a 12-mesh screen and stored for shipment.

I am inclined to think that others here will go more fully into the deeply interesting subject of the value of peat as a fertilizer, or as a filler for fertilizer. I desire, however, to call attention to a few points.

Much dispute has arisen as to the availability or solubility of the nitrogen content of peat, and laboratory experiments seem to prove that it is only partially soluble.

I am not sufficiently acquainted with the pepsin or the per-

manganate tests to say whether they can be depended upon to illustrate what may go on in the soil, but I do know from actual experiment that most encouraging results have followed its application to crops, and I am reminded of an occurrence in one of our colleges last winter that fairly illustrates the difference that may be noted between the operations of nature and those in the laboratory.

We have in Deland, Florida, a Baptist university, and as the control is largely in the hands of Baptist preachers, the absorption of alcoholic beverages is not countenanced by the faculty. They imported a professor of chemistry from Germany, who from his early youth had freely partaken of alcohol in many forms, and in a lecture to the students he descanted on the great advantages of a moderate use of alcohol to the human system as an aid to digestion, etc., and exhibited himself as a specimen of the Teutonic race whose strength had certainly not been unimpaired, but probably aided, by frequent drinks of beer, etc. He remarked that although alcohol, poured into a test tube and mixed with food, failed to digest that food, that there was no proof that alcohol was not a digestor, but it simply proved that the stomach was not a test tube. So strong has been the evidence that the nitrogen contained in peat helps plant growth to an amazing degree that I have come to the conclusion, with all due respect to Professor Haskins and others, that the processes of assimilation in the root of a plant cannot be duplicated in the laboratory.

The average fertilizer man buys this product on the unit basis and theoretically would give as much for anything containing a like percentage of nitrogen, but when, as has been proved in the test of the Springfield Filler Co.'s product in North Carolina, some 30 per cent. better results were obtained than with dried blood, per cent for per cent of ammonia, we are certainly justified in believing that crop tests in this case are worth more than those of the laboratory.

In my new plant I purpose using producer-gas made from peat in the Akerlund bituminous coal gas-producer. applying the same to a gas engine, and later by another producer to use peat gas for drying my peat for filler, using a Ruggles-Coles return tube drier.

This method of gas production saves part of the by-products in the shape of tar and ammonia.

In closing this short essay I have to thank you for the honor of giving me the opportunity of presenting it. In looking forward to the discoveries and utilization of peat in the next few years, what may we not expect without fear of exaggeration?

Personally I am immensely encouraged by this meeting, and spurred on to greater effort than ever before.

Born in old England and a resident of the United States for more than half my life, this constitutes my first visit to New England. This ground on which we tread is hallowed by reminders of the greatest men America has produced and pardonable is the pride of those who call this spot the Hub.

Outside of all profit or honor that may come to me as an investigator of the subject in hand, I shall ever feel that not the least advantage I have gained has been my visit to Boston.

PEAT IN RUSSIA.

The following is abstracted from a recent issue of Weekly Consular and Trade Reports, published by The Bureau of Manufactures, U. S. Dept. of Commerce and Labor, Washington:

The greater use of peat in recent years in the central and Baltic provinces of Russia, with corresponding demand for peat-making machinery, is given attention in the following communicaton from Consul Hernado de Soto, of Riga:

The recent rise in the price of naptha refuse, by compelling manufacturers to find substitutes for this convenient fuel, has been a main factor in the rapid development of the peat industry in the central governments (Moscow and others) where peat fuel is now supplied in several localities, at prices at which neither naphtha nor coal can compete.

The cost of production of machine-pressed peat is said by producers to equal 2.4 to 3.09 cents, or, on an average, 2.57 cents, for 36 pounds (the Russian unit of production is the pood, equal to 36 pounds.) Adding to this 1 cent for transportation and general expenses, the average cost of pressed peat fuel at the mill may be reckoned at 3.86 cents per unit, or $2.15 per short ton.

As 36 pounds of naphtha refuse possesses the same heating value as 3.5 times that amount of peat fuel, the former should sell at 13.52 cents per unit in order to compete with peat, or, adding the cost of transportation and other expenses to the cost of peat, of 1 cent, as above explained, naptha should not cost more than 14.52 cents for 36 pounds. At this price, it is not obtainable.

The conditions with regard to coal are similar. On a basis of a heating value of 2.5 times that of peat, the price of coal should not exceed 9.27 to 9.78 cents per pood, but this is below the market price. Thus peat has secured a dominant position in the central Russian fuel market. Seventy-three firms are at

present producing it, and the total quantity produced in 1908 is reported as 960,000 tons, equivalent to 275,000 tons of naphtha, or 383,000 tons of coal, while, during 1907 only 183,000 tons of peat fuel were produced in the same districts.

At the present rate of exploitation, the peat deposits will be exhausted, according to expert estimate, in about 40 to 50 years. There exist, however, in the same locality, a number of bogs which have not been touched, so that an early exhaustion of the peat supply in that section of Russia need not be apprehended.

The Fuel Question in the Baltic Provinces.

In the Baltic Provinces, where extensive bogs likewise occur, peat fuel has been used for some considerable time in the breweries and distilleries, but all attempts to introduce it as fuel for domestic use have hitherto been unsuccessful. This is attributed to the low price of wood, which is cheaper than peat and more adapted to the national stove. Since the year 1906, however, there has been a marked rise in the price of wood, which has all the indications of permanency, it having reached at one time last year, a price more than 50 per cent above that of 1906, and more than double that of 1892, since which year the general tendency with minor fluctuations only, has been constantly upward. The need of cheaper fuel has now become urgently felt, and attention has been drawn to peat as a possible substitute. A professor of the Riga Polytechnic School has, upon careful analysis, ascertained that peat from the local deposits, contains about 1,667 calorics per pound, while birch wood, the fuel mostly used in Riga, has only 1,476 calorics per pound. Extensive experiments made with the local peat, have proved the possibility of producing air-dried pressed briquets at 4 cents per pood at the bog. To this price must be added 1 cent for transportation, warehousing and other expenses, and 30 per cent profit, thus bringing the total cost per pood to 6.69 cents. This is considered sufficiently attractive to induce capital to invest in the industry, because the present market price for birch wood averages 7.4 cents per pood.

The same experiments also showed that the machinery employed was not adapted to a peat of recent formation, such as is found in the neighborhood of Riga, which contains much undecomposed. fibrous matter. For such peat, a special machine to tear and disintegrate the mass, preparatory to passing it through the rotary cutting machine, is required. Quite a number of satisfactory machines, manufactured in Russia, as well as others from Germany and Sweden, are in operation in the Empire.

In view of the probability that a serious attempt will be made before long to utilize Russia's rich peat deposits, it would

seem proper to draw the attention of American manufacturers of peat-cutting machinery to this coming possibility. (Consul de Soto's report was accompanied by a list, now on file in the Bureau of Manufactures, of dealers in machinery, who may be interested in receiving catalogues and prices of American manufacturers of peat machines.)

CONTINUOUS VACUUM FILTERS AS DEWATERERS.

By Robert Schorr, Engineer, San Francisco, Cal.

(Continued from last issue.)

A. Cost of filter installation for withdrawing 1½ to 2 tons of water per minute:

2 Filter machines, type No. 5, each with 400 sq. ft., royalty included	$ 7,000
2 Vacuum pumps, each 100 cu. ft. free air capacity per minute, belted type	800
2 Air compressors, each for 30 cu. ft. per minute free air capacity, belted type	500
1 Air receiver with fixtures and automatic speed regulator	200
All piping, valves and fittings	100
1 20-H. P. electric motor	450
All wiring, switchboard, etc.	150
All transmission details, including belting	150
Mill frame building, roofed and sided with corrugated galvanized iron	550
Excavation, foundations and labor for erecting, estimated	800
Figured total cost	$10,700
Add for emergencies, engineering, etc	1,300
Grand total, estimated cost of complete plant	$12,000

B. Average power requirement:

100 to 120 cu. ft. free air vacuum pump capacity, 10 to 20 ounces	4.5 to 8 H. P.
15 to 20 cu. ft. of free air per min. compressor capacity, 40 in.	1.8 to 2.5 H. P.
Power for two filter wheels	1 to 1 H. P.
Frictional losses in line shafting, etc.	1 to 1 H. P.
Total, from	8.3 to 12.5 H. P.

Say 12 H. P. or about 9 kilo-watts.

C. Yearly operating expenses and fixed charges:

365 x 24=8,760 hours x 9 K. W.=78,840 K. W. H. at 2c, about	$1,600
365 x 3=1,095—8-hour shifts at $2, about	2,200
Supplies: New cloth, lubricants, etc., about	1,000
10% for depreciation and repairs = $12,000 x .10	1,200
5% interest upon the investment	600
Figured total	$6,600
Add for unforeseen	600
Grand total	$7,200

Seven hundred and fifty tons of peat with 60 per cent. moisture × 365 days = 273,750 tons per year; consequently we have $7,200 ÷ 273,750 = 2.7c as cost per ton of filtered peat, or $7,200 ÷ 300 × 365 = 6.5c as cost per ton of dry peat substance.

There is no doubt that with many older peat varieties more thorough dewatering could be expected by employing vacuum filters, but hardly less than from 45 per cent. to 50 per cent. of moisture. Modern peat gas producers can be operated with wetter feed, but it is obvious that higher efficiencies and better results are obtained by using drier peat. To effect a further reduction in moisture, the waste gases from boilers and distilling retorts, or the exhaust from gas engines can be used to good advantage.

In looking over the figured cost of de-watering peat with continuous filters, those who have had experience with air-drying will agree that this could not be accomplished as cheaply, even with the aid of modern mechanical handling arrangements. If hand labor is employed, the cost is many times as much.

Furthermore, the filter installation permits of operating peat plants of every description, throughout the year, and the expense of bog-drainage is saved also. This article is restricted to "Filtering," and is not intended to deal with other peat problems. I have chosen the subject merely to illustrate the adaptability of such continuous filtering machinery, wherever large quantities or water, or other liquids, have to be expelled. As mentioned previously, these machines are extensively used in cyaniding, and more recently, also for unwatering mill-pulp and tailings in place of settling-boxes, mechanical pulp-thickeners and screens. The sand, if of value, is thereby put in better condition for the next step in the process, and, if it is a waste, it is more easily handled, while the water can be used over again. The approximate cost of such installations is from $1,000 to $4,000 per 100 square feet of filtering surface, and the average power requirement ranges from 1.25 H. P. to 6 H. P. The advantages which

continuous filters have over all intermittent types are numerous; they are entirely automatic, there are no time losses, no storage tanks or pumps, they cover a very small floor space and they require but little power and attention.

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Communications intended for the Editorial Department should be sent to the Editor, Charles A. Davis, 1732 Columbia Road, Washington, D. C., or to one of the Associate Editors.

EDITORIAL.

The readers of The Journal have doubtless been somewhat concerned at the long interval of time which has elapsed since the appearance of the last number, but those in charge of the publication have firm hopes that the present issue will prove such a pleasant surprise that the delay in its appearance will be overlooked and forgotten. The publication of the entire proceedings, a radical departure from the usual custom, has been made by the Editor partly as an experiment and more largely through the hearty interest of our honored President, who desired to have the proceedings of the Ottawa meeting printed in full and was able to secure assistance so that this could be done. Those who derive benefit from this number should fully understand that it was possible to print it only because Dr. Haanel has made it so.

The Editor wishes to take this opportunity to repeat, after time for full consideration, what he said at the time of the meeting, that it will hardly be possible for the Society to have a more

thoroughly satisfactory meeting, in all ways, than that held in Ottawa. There will doubtless be times in the near future when the attendance at the annual meeting of the Society will be larger, but it is doubtful if ever the percentage of the delegates present at all of the sessions is larger or the interest in the proceedings is greater. It is certain that no future meeting can present more interesting and instructive features, or novelties, to the majority of those attending, because at this meeting most of the members present saw for the first time a thoroughly practical and practicable peat fuel plant in full operation with abundant evidence in the hundreds of tons of the product in various stages of completion, or in storage, that the operation of the plant was not a matter of an occasional exhibition run, but had been going on for weeks on a scale that was plainly commercial. Still more impressive was the gas-producer plant, because it was so novel to see such an installation and to see so fully demonstrated that peat can be used so satisfactorily for the production of power. These practical exhibitions by the Government were supplemented by the many excellent papers, some of which presented novelties of unusual merit and possibilities.

The remembrance that will remain longest in the minds of those who attended the meeting, however, is that of the hospitality of the people of Ottawa and of Canada, as expressed by the Officers of the Dominion Government in the delightful entertainment given the Society.

The following quotation appeared as an editorial note in "Power and The Engineer" for September 13, 1910 (Vol. 32, No. 37), and it is reproduced here in order that the readers of this Journal may see how even conservative engineering journals are taking serious notice of the signs of the times, in the matter of the possibilities of peat fuel:

"In Europe conservation long ago ceased to be a fad. On the Continent conservation is a vital issue; the people are in dead earnest,—they have to be. Farms are cultivated to the very edges of the highways and railroad rights of way. The unending struggle is to make the ground yield more and to make that which is yielded go farther. The people there practice economy to a degree which is as yet undreamed of in America.

What applies to the food products applies also to fuel. Industrial prosperity demands a fuel of reasonable cost.

Some countries, as for example, Sweden, Norway, Denmark, Finland and Holland, have practically no coal deposits and are forced to import what they need. During war times a country would be seriously handicapped if its fuel supply were suddenly interrupted. For this reason the governments

of those countries which have little coal are keenly interested in the development of a suitable substitute which can be produced within their own borders.

Peat, which is found in great abundance in all parts of Europe, has given satisfaction as a fuel. In Holland it has been used for centuries. The production of peat at the present time is over a million tons per year. In Russia the annual output amounts to over four million tons. The peat-fuel resources in other parts of Europe are proportionately well developed. America also has vast peat deposits. The United States, exclusive of Alaska, has over eleven thousand square miles of peat bogs. Canada has more than thirty-seven thousand square miles of bog land.

In many places, especially in Canada, peat fuel would find a ready sale if it were offered at a price which would compare favorably with that of coal.

It is easy to burn and is comparatively free from smoke. Its heat value is about 40 to 60 per cent. of that of coal, and it would appear that the most efficient way in which to use peat for power generation is in a gas-producing plant.

The peat-fuel industry has not been a success in America due to the comparatively low cost of coal and the imperfect machinery which has been used for handling the peat.

The Canadian government is doing a great work at its experimental stations in demonstrating that peat can be used profitably for industrial purposes. These stations are described in this issue.

The United States Government also is making considerable effort to encourage the development of the possibilities which peat fuel possesses. Several large industrial and engineering concerns are making investigations to determine for their own benefit the availability of peat for power generation.

These facts indicate that the time is not far distant when peat will play an active part in the conservation of the American coal supply, just as it is doing at the present time in the less richly endowed countries of Europe.

The methods of handling and using this product are not as yet highly perfected. However, the fact that so much interest is being taken in peat, is a token that great progress may be expected within a few years."

Mr. Robert Ranson, Vice-President of this Society for the Southern States, writes in a recent letter from London, England, where he is now sojourning, that his stay there is indefinitely prolonged by business engagements. He states that he has found great interest in peat development in England and a surprisingly large number of peat fuel plants in opera-

tion. It is hoped that he will soon send the Journal a letter for publication relating some of his observations.

Mr. Herbert Philipp, Secretary of the Executive Committee, wishes the announcement made that he will be glad to receive letters of inquiry relative to the uses of peat in agriculture, or as agricultural land. His address is Perth Amboy, N. J. Mr. Philipp is actively interested in the work of the Society, and has recently agreed to assume a part of the editorial work, as well as that involved in his duties as Secretary of the Executive Committee.

The Peat Engineering Company of Toledo, report business prospects excellent for the coming season, with interest awakened earlier than usual.

Mr. L. B. Lincoln, Vice-President of the American Peat Society for the States of Illinois, Wisconsin and Iowa, has opened an office at Room 632 American Trust Building, 125 Monroe St., Chicago, Ill. Mr. Lincoln hopes to make his office the headquarters of the Society in that section of the country and will be glad to have inquiries relative to peat utilization and the occurrence of peat in his region sent him.

Mr. Max Toltz, of St. Paul, Minn., Vice-President of the Minnesota section, in a recent visit to New York, said that the price of swamp land in his State was being rapidly advanced by the many drainage developments for agricultural purposes and the agitation of the peat fuel question. This is as it should be, for swamp lands are potentially very valuable property.

Kalamazoo, Michigan, the place at which the Annual Meeting of the American Peat Society is to be held in 1911, is famous for the intensive farming done on peat and muck lands, which used to be swamps in earlier days. It is also the home of one of the few men in the United States who has successfully produced peat fuel in quantity for a number of years, Mr. Carl Kleinstueck, who has been a Vice-President of the Society since its beginning. Mr. Kleinstueck writes that arrangements for the coming meeting are already being made.

Correspondence and Communications from the members of the Society are solicited by the Editor, for publication, and it is hoped that many who have promised such matter will not forget to send it in at once. Notes of progress of all sorts are needed to make the Journal of the highest use and interest, and personal information is also very desirable in order that the members of the Society may keep track of each other.

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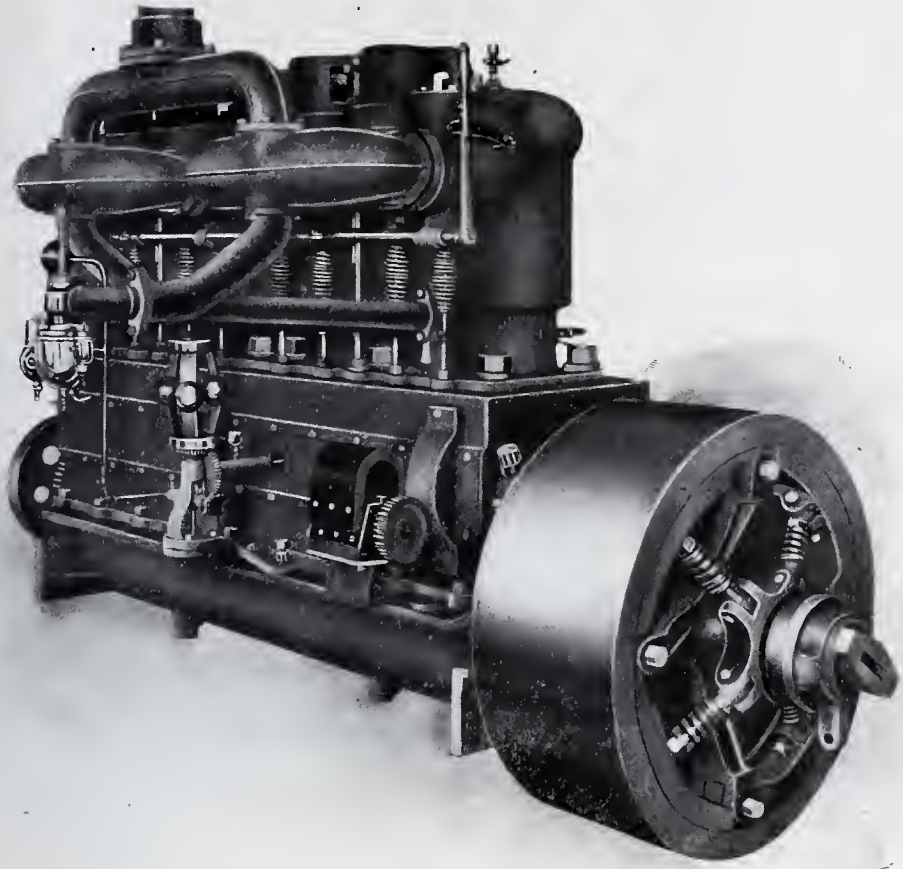

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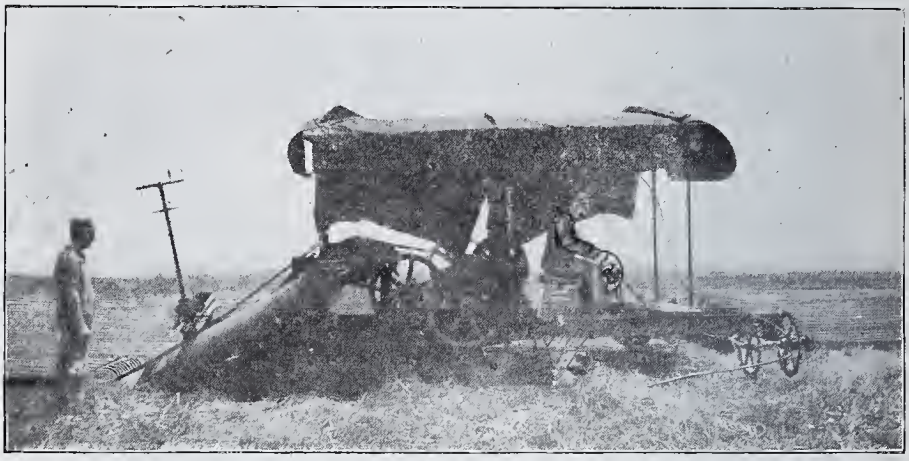

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Devoted to the Developement of American Peat Resources

CONTENTS

1—The Peat Resources of Minnesota. *Max Toltz*
11—Multum in Parvo. *The Peat Engineering Co.*
14—The Peat and Muck Lands of New York. *M. Earl Carr*
20—A New Process for Coking Peat. *W. I. Shepard*
23—The Process of the Peat Manufacturing Company. *Walter J. Creamer*
24—Problems of Production of Peat Fuel for Gas-Producers. *Charles A. Davis*
26—Editorial Notes.
35—Correspondence.
37—Questions.
38—A Review.
39—Publications Received.
40—Annual Meeting.

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Annual Meeting

The Annual Meeting of the American Peat Society for 1910, will be held at Ottawa, Canada, on Monday, Tuesday and Wednesday, July 25, 26 and 27.

The Canada Department of Mines, Mines Branch, has a peat fuel plant in operation near Ottawa, in which the best European methods and machinery are in use, under the direction of Mr. A. Anrep, Jr. In Ottawa, the Koerting Gas-producer for peat fuel, also installed by the Department of Mines, will be in operation, and ample opportunity will be given every member of the Society to examine both of thes plants.

A program embodying the results of progress in peat utilization, during the year, will also be presented, and it is hoped that all members of the Society, and others not members who are interested in getting exact information, and in seeing for themselves the possibilities of peat fuel, will attend this meeting.

For full information, programs, etc., apply to the Secretary, Julius Bordollo, Kingsbridge, New York, N. Y.

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